Income Development in Norwegian Municipalities

A Descriptive Analysis of 16 Norwegian Municipalities Over 150 Years

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Abstract

More than 60 years ago Simon Kuznets found an empirical relationship between inequality and economic growth, which developed into the well-known inverted U hypothesis, first published in 1950.

This thesis describes the development in 16 municipalities focusing on five variables, in relation to Kuznets inverted U hypothesis. These are population growth, industry structure, mean income, income inequality and poverty. The Norwegian economy has developed from a preindustrial economy with few cities and a small government sector to an economy based on modern service industries, large and populated cities and a sizable government sector. Mean income has increased, and the poverty rate has declined.

In addition, this thesis suggest that income inequality declined until the beginning of the 1990s, but after this the trend has been increasing. This gives a relationship between income inequality and economic growth that is more similar to an actual U than the inverted U found by Kuznets. The recent increase in income inequality is likely to be related to a deregulation of financial markets in 1984 and reduced taxes on capital income in 1992. In addition, 1992 was the end of the Norwegian banking crisis, and a turning point in the Norwegian business cycles, after an economic downturn during the previous years. This was also a period of structural change from traditional manufacturing to service industries. Second, a converging trend between municipalities is discussed. The industry structure between municipalities has converged over the period. This convergence was also seen in mean income, and in income inequality before 1990. After 1990, however, income inequality between municipalities diverged.

Preface

This thesis represents the completion of a five- year master's program in Economic Theory and Econometrics at the Department of Economics, University of Oslo.

The thesis is written through my job as a research assistant in the Research Department at Statistics Norway. All the data material I have used is also provided by Statistics Norway.

First and foremost, I would like to express my deepest gratitude to my supervisor, Jørgen Modalsli at Statistics Norway for his help and engagement, which has been far beyond what one can expect from a supervisor. This includes sharing his knowledge on the subject and providing helpful advices and comments whenever needed regarding absolutely every aspect of the thesis. He also deserves a great thanks for help and inspiration in the beginning of the work with the thesis, especially in defining the scope and structure of the thesis. In addition, I would like to thank Rolf Aaberge at Statistics Norway for helpful comments during all phases of this project. He has served as a second supervisor, and has also shown great enthusiasm for the topic, which has made this process more exciting for me as well.

Second, I would like to thank two Research Fellows at the Department of Economics for being sources of inspiration and for always keeping their door open. A special thanks to Katinka Kristine Holtsmark, not only for inspiring me into studying economics, but also for all help and advice during my studies. I would also like to give a thank to Nina Larsson Midthjell for her guidance and advice during the last year of my studies, which has meant a lot to me.

I would further like to thank everyone else who have contributed into making these five years of studying economics educational, inspiring and engaging. In particular, I would like to thank Marte, Eirik and Gaute, for all talks, meals and technical support throughout this last semester. In addition, I am very grateful for the help from both Christina and Line in proofreading the thesis and for all other moral support through the last years. Last, but not least I would like to thank my mum, dad, sister Christina and the rest of my family and friends for supporting me and keeping me motivated.

Any inaccuracies or errors in this thesis are my responsibility alone.

Jeanette Strøm Fjære

January 2014

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1 Introduction

More than 60 years ago, the economist Simon Kuznets described the long run development in income inequality, using cross-section data available at that time, Kuznets, 1950, 1955. He found a relationship between economic growth and income inequality resembling an inverted U. This empirical relationship evolved into the well-known hypothesis called the inverted U hypothesis. According to Kuznets, income inequality will first rise, for then to decline as a country undergoes a process of economic development. The reason is that the technological changes that characterize this development process are first uneven, then compensatory.

In the beginning of a development process some sectors will benefit more than others, for instance because these sectors are able to make use of new and more efficient technologies. In this phase changes are uneven, and consequently the inequality within the country rises. In the following periods inputs to production will move towards the expanding industries, and more people will acquire the skills necessary to take part of the development process. In addition, increased income in the growing sectors will lead to more demand for all goods and services. This will create growth also in other sectors. In this phase changes are compensatory and inequality is declining. This gives an inverted U relationship between income and income inequality.

Today, more than 60 years after Kuznets published this hypothesis, the economic growth and structural changes have developed even further. But is the relationship between income inequality and economic growth still the same as the relationship found by Kuznets in 1950? The period from 1950 up until today has not only given us a longer time horizon to investigate, it has also been a period when new data material on income dating far back in time has been discovered. Rich data material at municipality level in Norway, covering more than 150 years, makes it possible to investigate whether the hypothesis of Kuznets holds when using new and more rich data material for Norway, and when expanding the time period to include the period from 1950 until today.

The focus in this thesis will be on answering two main questions related to the inverted U hypothesis;

Has income inequality in Norwegian municipalities been rising or falling over the last 150 years?

Has the industry structure in Norwegian municipalities converged over the last 150 years? If so, has this affected income growth or income inequality?

To be able to give such answers, the economic development in 16 municipalities throughout Norway will be studied. The analysis in this thesis will include figures on five selected variables over a period from the 1850s up until today, using historical data sources for figures dating far back in time. The selected variables are population, industry structure, income, income inequality and poverty. The five variables are chosen to get a complete understanding of the income development in the 16 municipalities, but the availability of the historical data material has, however, been crucial in this selection process. There have been several challenges when comparing data material over such a long period, and the aim has been to make the figures as comparable over time as possible.

The reason for not covering all the municipalities is simply that the collection of data for the period prior to 1967 is time consuming, since there are no electronically available data. But in principle this analysis could be done for any municipality in Norway. 16 particularly interesting municipalities have been chosen, based on including the most populated areas in Norway, that they cover a large geographical area and different industry structures.

The thesis is structured as follows. In section 2 a brief introduction to the background for this thesis and some of the literature within this field is given. Section 3 gives a discussion of the methodological approach used in the data analysis, including the selection of the 16 municipalities and the measure of income inequality. Also, the challenges in comparing data over long time horizons, and the measures used to create time series for each variable, is explained. Further, the data analysis for each variable is presented in section 4. A discussion of the findings is given in section 5, followed by some concluding remarks in section 6.

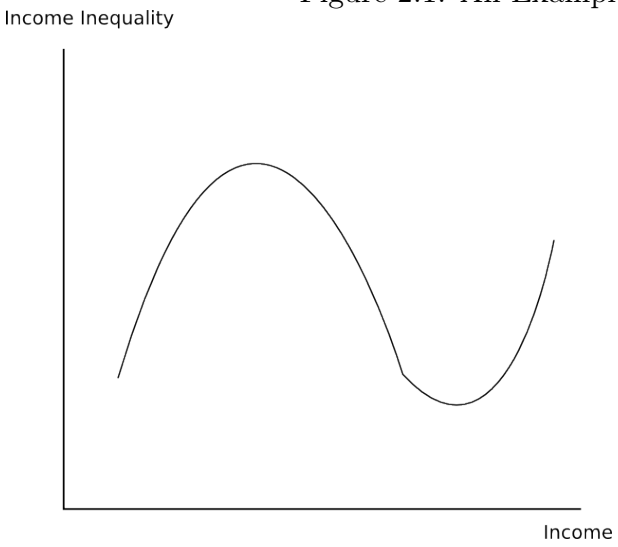
2 Literature and Background

This section gives a brief discussion of the background for this thesis. First, some of the theories on the long run development of income is discussed. In particular, the inverted U hypothesis is explained, which focuses on the relationship between income inequality and economic development. Also, the empirical evidence concerning this hypothesis is included. Further, some of the literature on the long run income development in Norway and the Norwegian economic history is presented.

2.1 Kuznets and the Inverted U Hypothesis

The link between economic growth and income inequality has been discussed thoroughly for many years within the field of economics. However, a general theory on how these variables correlate over time does not seem to exist. The earliest attempt to correlate income inequality and economic development was done by Kuznets [1950]. His work started out by an empirical relation, and evolved into an hypothesis suggesting that income inequality first rises for then to decline, as a country undergoes a process of economic development. The reason for this, he claims, is that technological changes are first uneven, then compensatory.

Figure 2.1: An Example of the Inverted U Curve



In the beginning of a development process some sectors will benefit more than others, for instance because these sectors are able to make use of new and more efficient technologies. In this phase changes are uneven, and consequently the inequality within the country rises. In the following periods inputs to production will move towards the expanding industries,

and more people will acquire the skills necessary to take part of the development process. In addition, increased income in the growing sectors will lead to more demand for all goods and services. This will create growth also in other sectors. In this phase changes are compensatory and inequality is declining. This gives an inverted U relationship between income and income inequality, as shown in Figure 2.1.

Kuznets [1955] also emphasizes the impact of urbanization on income inequality. He argues that both income per capita and income inequality is usually higher in cities than in rural areas. In a development process of industrialization and urbanization, income inequality will rise for two reasons. First, the share of the population living in urban areas increases, which is the more unequal income distribution of the two. Second, the relative difference in per capita income between the rural and the urban population might increase. The reason is that the productivity in urban industries rises faster than the agricultural productivity in rural areas. This will also increase income inequality. Eventually, income inequality will start to decline as low income groups gain more influence over political decisions in the cities. The political pressure on governments to ensure redistribution and taxation of the richest will increase, driving down income inequality.

Atkinson and Piketty [2007] investigate the top income shares in the US and in several European countries, using comparable income sources and methods for all countries, and relate their findings to the inverted U hypothesis. They explain that income inequality decreased between 1915 and 1948, but not because of the gradual, structural changes as proposed by Kuznets. Income inequality declined during a politically chaotic period, particularly it declined during the two world wars and in the early 1930s, during the Great Depression. The decline was entirely due to a fall of top capital incomes. The explanation for the decrease in income inequality is thus that capital owners incurred severe shocks to their capital holdings, as destruction, inflation and bankruptcies, during this period. This is confirmed by available wealth and estate data. But it seems like everything else, for instance wage incomes, has been stable over the same period. It is also true, as proposed by Kuznets [1955], that the number of low wage workers in rural areas have decreased over this period, but only to be replaced by low wage workers in cities, meaning that this is not what caused income inequality to decrease. Atkinson and Piketty [2007] also explain that the top capital incomes did not increase again after 1948 because of the introduction of progressive taxes.

After 1948 income inequality remained stable or kept declining at a slower pace in most countries. After the 1970s, however, there was a divergence in income inequality among rich

countries. Income inequality started increasing again in some countries. This is what is illustrated to the right in Figure 2.1. In particular, inequality increased in the US, where it was driven by increased top wages. Goldin and Katz [2008] claim that a slowdown in the educational attainment in the US is the explanation for the increasing inequality. They also point towards institutional explanation factors, such as a decline of unions, a less generous social safety net and the erosion of other labor market institutions that protected low- and middle income workers. But also in many European countries income inequality increased during the latest decades, but here it was driven by increased top capital incomes, not top wages as in the US.

Several other researchers have also tried to test the inverted U hypothesis. Thomas [1991] argues that there are more evidence supporting the declining part of the inverted U-curve, than the rising part. Also Lindert and Williamson [1985] show a decline in the top income shares in Great Britain, USA, West-Germany, Preussen, The Netherlands, Sweden and Denmark in the time period from 1867 to 1979. One reason that the increasing part of the curve is more difficult to find evidence for is that there are no available income data that far back in time. But Williamson [1991] finds some evidence for the rising part of the curve for Great Britain from 1801 to 1867. Still, one can only conclude that a relation between economic growth and inequality resembling an inverted U exists in some countries, while in others it does not. More importantly, it is difficult to conclude that the relationship is explained by the hypothesis of uneven and compensatory changes.

Gottschalk and Smeeding [2000] investigate the development in income inequality between 1980 and 1995. They find an increasing trend in income inequality over this period for most countries included in the study, also for Norway. Furthermore, they find that the Gini-coefficient[1] increases by more than 2 per cent per year in the UK, and by 1 per cent per year in Sweden, the Netherlands and Australia. In Japan, Taiwan, the US, Switzerland, France, Germany and Norway it increases by 0,5 to 1 per cent per year. They find no change in Israel, Canada, Finland and Ireland, and only a modest decline in Italy.

2.2 Income Development in Norway

To study economic changes over time long-run time series of data are needed. Concerning income inequality the data will have to cover the whole income distribution. Such data is limited in most countries for the time period prior to the Second World War. In addition, the definitions of these measures change over time, making comparisons of figures over the

[1]See section 3 for an explanation of the Gini- coefficient.

whole period challenging. Still, some studies of the economic development over the last 150 years have been done, also for Norway.

Aaberge and Atkinson [2010] analyze the historical development of top income shares in the Norwegian adult population[2] from 1875 to 2006. They use tabulations of the distribution of income as assessed for tax purposes prior to 1967, and micro-data from the tax register files available to Statistics Norway from 1967 to 2006. Their findings suggest that the income shares of the 10 per cent to 0,5 per cent of individuals with the highest income both rises and falls for short periods, but that the top income shares declined steadily from 1875 to 1948. At the same time the Norwegian society developed from a pre-industrial to an industrial society, experiencing economic growth and a shift of the population from rural to urban areas. But as explained in Atkinson and Piketty [2007] the decrease could be caused by shocks to the capital owners capital holdings during the world wars and the Great Depression. From the post war period until the late 1980s the top income shares continued to decline. During this period taxes gradually increased, and the Norwegian welfare state expanded.

From the early 1990s the top income shares rose again, largely because of an increase in the income shares of the top 1 per cent. This might partly be explained by the financial deregulation in 1984 and the tax reform in 1992, when taxes on capital income was reduced, making the distribution of capital income more uneven. This is similar to the findings for many other European countries in Atkinson and Piketty [2007]. In addition the Norwegian banking crisis ended in 1992, and there was a change in business cycles towards an economic upturn with lower unemployment and stronger growth. Also, there was a structural change from traditional manufacturing to services and technology during this period.

A temporary tax reform on dividends in 2001 and a permanent dividend tax in 2006 gave an increase in the top income shares in 2000 and 2005, and a following decline, however smaller than the increase, the year the tax was introduced. This creates some interpretation problems, but still Aaberge and Atkinson [2010] show an increasing trend in the top income shares overall from the 1990s and onwards.

Solbu [2009] bases his analysis on the same data material as Aaberge and Atkinson [2010], but he investigates the whole income distribution for the population covered by the tax statistics from 1858 to 2006. He uses three different measures on income inequality, one of them being the Gini- coefficient. As in Aaberge and Atkinson [2010] the data material is

[2]The adult population is taken to be those aged 16 and over.

based on tabulations of the income distribution in certain years prior to 1966, and micro-data from tax register files is used from 1967 to 2006. Prior to 1966 he uses state tax statistics in some years, while he uses municipal tax statistics in other years to create a time-series over the whole period. In 1858 the figures are based only on cities in Norway. Because a larger part of the population in general was covered by the municipal tax statistics, and since the development in cities most likely differed from other areas in Norway, this gives some inconsistency to the results. In addition there are only a few data points before 1966. His results are in general similar to those for the top income shares from 1875 to 1945 and from 1990 to 2006, and are also in line with the results of Soltow [1965] prior to 1960.

Lund [2012] studies the development in income inequality measured by the the same three income inequality measures as Solbu [2009] in Norway from 1894 to 2010. Her estimation method is, however, different from that of Solbu [2009], prior to 1967. Lund [2012] takes advantage of both state tax statistics, municipal tax statistics and poverty statistics to create four income groups. These groups are used to estimate income inequality from 1894-1966.

She also distinguishes between urban and rural areas. She finds that the income inequality in urban and rural areas develop somewhat differently in the period before 1960. In rural areas income inequality follows an inverted U pattern as proposed by Kuznets [1950], while only the declining part of this curve is visible for urban areas. In other words, it seems like income inequality started falling earlier in urban areas. Kuznets [1955] argues that income inequality would increase in the beginning of a period of urbanization and industrialization. The results of Lund [2012] shows the opposite, income inequality was lower in urban areas, and started decreasing earlier in urban areas as well. From the 1960s until today urban and rural areas follow a similar pattern of declining income inequality until the early 1990s. The results in this period are in line with those of Mjelve [1998], who emphasizes the importance of the development of the welfare state, securing redistribution and more equal opportunities for everyone. This gave rise both to declining inequality over time, and a more similar income distribution across different areas.

From 1991 to 2010 inequality rises, and it rises more in urban than in rural areas. However, the income inequality Lund finds evidence for rises less than the top income shares in the study of Aaberge and Atkinson [2010]. This suggests that the rise in income inequality over the last decades is mostly due to a rise in the top income shares.

Soltow [1965] investigates the development in income inequality for all employed men in eight selected cities in the Norwegian counties Østfold and Vest-Agder for the period 1840 to

1960. His study is based on Norwegian tax statistics, collected at local tax offices. He finds that income inequality has fallen over the time period. His explanation is more competition in product- and service markets, a more even distribution of real-estate income, economic compensation from the government, and greater education opportunities for everyone.

Mjelve [1998] builds on Soltows study, but includes data for the years from 1960 to 1990. Her findings suggest that income inequality has been falling over time in all the eight selected cities, as well as a converging income inequality between the cities. This can be explained by a more heterogenous economic basis in the earlier decades the study focuses on. A large part of income was typically based on a few particular industries in each city. Therefore, economic shocks striking one or a few industries could greatly affect the economic development in a city where these industries were important, while the economic situation in other cities remained unaffected. Further, the evolution of income inequality was different between the cities. For the later decades the economic basis in the cities is more homogeneous and broad, making the income distribution more equal between cities. This also made the economy less prone to economic shocks striking particular industries.

2.3 The Norwegian Economic History

Hodne [1981] and Hodne and Grytten [1992] describes the Norwegian economic development over the last 200 years. Before the 1830s Norway was a traditional agricultural economy, characterized by low consumption and a high degree of self sufficiency. The Norwegian population was 1,1 million, and few cities with a population above 10 000 existed. Around 75 per cent of the working population was involved in primary industries, while secondary- and tertiary industries were close to non existing.

Norway experienced appreciable economic growth for the first time in the period from 1830 to 1875. Much of the development was driven by the traditional sectors at this time. In the period from 1875 to 1905 the economic growth was moderate compared to other European countries. This led to a massive emigration to the United States and a structural transformation of the economy, where industrial sectors grew and traditional sectors became less important. A larger share of the population moved to cities and other populated areas, where new jobs were created.

From 1905 to 1915 Norway experienced an average growth rate of 3,9 per cent. Both primary and secondary industries, including shipping, grew rapidly. Also public services and the role of

the government became more important. During the First World War, Norway was a neutral country and the Norwegian economy went from already strong growth to overheating.

From 1920 to 1932 Norway experienced three crises, and although the economic growth continued, the unemployment rate increased significantly, and remained high until after the Second World War. During the 1930s there was increased growth in industrial sectors, after a period of stagnation during the 1920s.

The period after the Second World War has been the strongest growth period in the Norwegian history, and also the economically most stable period. These decades were characterized by a decline in primary industries, as well as a decline in secondary industries from the 1970s, along with a steady increase in the share of population employed in service industries. The overall employment also increased, which can largely be explained by women's entry into the labor market, while the economic growth partly can be explained by growth in the oil industry. Another important change during this period is the expansion of the public sector. Taxes and social benefits were increased and the focus was set on social security and welfare for all.

3 Methodological Approach

This section will treat the methodological approach in this thesis. First, the selection of the 16 municipalities is explained. Further, the measure of income inequality is introduced. Finally, the estimation process of each variable, and the challenges in comparing data over a 150 year long time period is discussed.

3.1 About the Selection of Municipalities

Today Norway consists of 429 municipalities. In this thesis only 16 of them will be studied, where 10 of them are cities, and 6 are located in rural areas. A natural question to ask is why exactly these 16, out of the 429 municipalities, have been chosen. The reason for not covering all the municipalities is simply that the collection of data for the period prior to 1967 is time consuming, since there are no electronically available data. But in principle this analysis could be done for any municipality in Norway.

The municipalities have been carefully chosen such that the most populated areas in Norway are represented, as well as to cover a large geographical area. The selection is not a random sample from the total number of municipalities, and is in this matter not representative for the Norwegian population. The aim of this thesis is, however, not to provide results that are representative for Norway as a whole, but rather to investigate some particularly interesting municipalities with regards to industry structure and economic development.

What makes these 16 municipalities particularly interesting, is their development in industry structure. Between some municipalities there has been a convergence in industry structure over time, while between others the development in industry structure has been similar over the whole period. With these 16 municipalities it is then possible to investigate whether the municipalities where the industry structure has converged have also experienced a convergence in mean income and income inequality. Also, one can study if the municipalities that have experienced a similar development in industry structure over the whole period have experienced the same concerning mean income and income inequality.

The selected municipalities have been divided into four categories, depending on their industry structure. The first category consist of the five largest cities in Norway, Bergen, Kristiansand, Stavanger, Trondheim and the capital, Oslo. These municipalities have developed in a similar way, with primary industries being almost non existing during the whole period, and secondary industries becoming increasingly replaced by tertiary industries. The

second category is traditional agricultural municipalities that have developed into service industries, and consist of the three municipalities, Nord-Aurdal, Sogndal and Vinje. These municipalities have also been similar over the whole period. The third category is industrial municipalities and consist of the rural municipalities, Røros and Sauda, and the cities, Kongsberg and Moss. These four municipalities have all been dependent on industrial sectors at one point in time, but they started out differently in 1865 and ended up more similar in 2010. The last group is four municipalities located along the coast, where fishery and maritime industries traditionally have been important. These municipalities are Ålesund, Bodø, Vestvågøy and Vadsø. In this category, as for the third category, the industry structure has converged between municipalities. In the first and second category, on the other hand, the industry structure have been similar between the municipalities over the whole period. An overview of the 16 municipalities is given in Table 3.1.

Table 3.1: Overview of the 16 Municipalities and Population in 1865 and 2013

Large city municipalities	Population 1865	Population 2013	Average annual population growth rate
Stavanger	16647	129191	1.39%
Bergen	30422	267950	1.48%
Trondheim	19287	179692	1.51%
Oslo	57382	623966	1.62%
Kristiansand	10876	84476	1.39%

Agricultural municipalities	Population 1865	Population 2013	Average annual population growth rate
Nord-Aurdal	6074	6396	0.03%
Vinje	2965	3721	0.15%
Sogndal	4247	7477	0.38%

Industrial municipalities	Population 1865	Population 2013	Average annual population growth rate
Moss	5785	30988	1.14%
Sauda	1899	4745	0.62%
Røros	3515	5589	0.31%
Kongsberg	5011	25887	1.11%

Coast municipalities	Population 1865	Population 2013	Average annual population growth rate
Bodø	519	49203	3.12%
Vadsø	1344	6163	1.03%
Vestvågøy	4880	10870	0.54%
Ålesund	3658	45033	1.71%

Source:NSD Kommunedatabase [2013b]

The municipal division has changed since it was originally established in 1837. For this reason it has been challenging to create time-series that cover the same geographical area over time. A detailed overview of the population transfers due to changes in the municipal division is given in Appendix A. The data material is available for each municipality as it was defined in the year the data was collected, not as the municipalities are defined today. The way this issue is solved is different for the rural and the urban municipalities.

Table 3.2: The Rural Municipalities

Municipality	Added municipalities		
Nord- Aurdal	Sør- Aurdal	Etnedal	
Vinje	Rauland		
Sauda			
Sogndal			
Røros	Røros Landssogn	Brekken	Glomås
Vestvågøy	Hol	Borge	Valberg

For the rural municipalities, groups of municipalities are created, as shown in Table 3.2. The groups are created by adding the municipalities for which transfers and changes of borders between these municipalities and the chosen municipality have occurred during the time period studied, to the chosen municipality. The total geographical area the groups are covering will then be investigated over the whole period. The areas the groups are covering have not changed through time, as there has not been any changes between the municipalities within the groups and the rest of the Norwegian municipalities. Still, some minor changes of borders are ignored, where only a small part of the population has transferred, since these minor transfers do not affect the results.

For the urban municipalities the fact that municipal borders have changed is ignored. There are three main reasons for this. First, the analysis is meant to cover both cities and rural areas, and to see how areas with varying characteristics develop differently. If a similar group of municipalities is created for the urban municipalities, municipalities that are not defined as cities will be added to the actual cities. In this way the chosen city-municipalities would lose some of their characteristics as a city. Second, the largest cities have experienced many population transfers and border changes, which would make the groups large and complex. Third, the data material used for the period before 1967 is limited for all municipalities, but even more so for the rural ones. If a group consisting of both cities and rural areas would be studied, there would be data at some points in time covering only the cities in the group. Therefore it can be argued that creating such a group for the cities would require much work without giving more consistency to the time series.

Still, an analysis of the capital municipality, Oslo, including the total group of municipalities is done in Appendix D. The findings suggests that adding the group does not change the results.

3.2 Measuring Income Inequality

One of the main measures of interest in this thesis is inequality. When analyzing inequality it is important to be precise concerning which definition of inequality that is used. In this thesis inequality in income between individuals in the population above 15 years of age will be considered. Clearly, individuals will also have other sources of wealth, but income is one of the few indications of wealth where data material exist over a long time period. Also, there are clearly other factors affecting an individuals welfare than the individuals wealth alone. But since these factors are more difficult to measure, income will be used as an indication of welfare in this thesis.

Further, it is not obvious how to rank different income distributions from the most equal to the most unequal. What is clear is that an income distribution where one person earns all income, while the rest of the population earns no income, is more unequal than a distribution of income where everyone earn the same. However, it is difficult to range income distributions when they become more complex, which is the most realistic case.

3.2.1 Important Criteria

The aim is to find a measure of inequality that can be used to study the development of income inequality over time, and that is consistent with how people intuitively perceive inequality. A measure of income inequality is a rule that assigns a degree if inequality to each possible distribution of income. Such a measure can be interpreted as a function of the form

$$I = I(y_1, y_2, \ldots, y_n) \tag{1}$$

defined over all distributions of income $(y_1, y_2, \ldots, y_n)$.

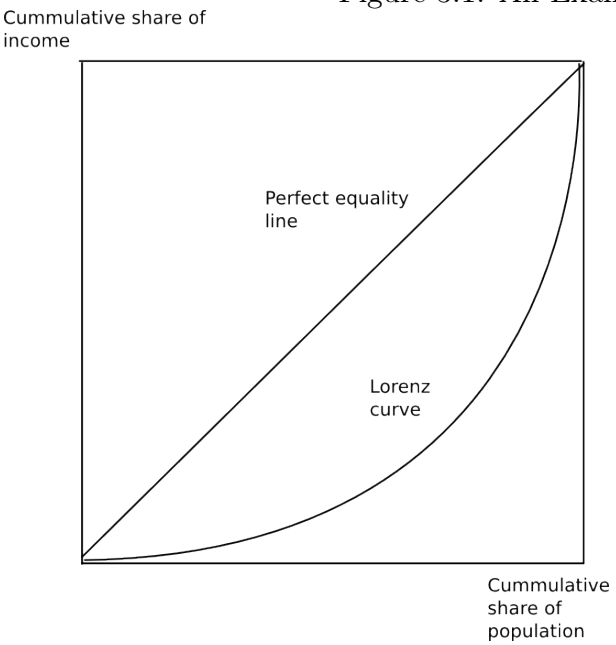
Several inequality measures exist, and Ray [1998] lists four criteria any such measure should satisfy.

1. *Anonymity principle.* The function I is completely insensitive to all permutations of the income distribution $(y_1, y_2, \ldots, y_n)$ among the individuals $\{1, 2, \ldots, n\}$.

2. *Population principle.* The function I is completely insensitive to population size, meaning that $I(y_1, y_2, \ldots, y_n) = I(y_1, y_2, \ldots, y_n; y_1, y_2, \ldots, y_n)$.

3. *Relative income principle.* The function I is completely insensitive to absolute levels of income, such that for any $\lambda > 0, I(y_1, y_2, \ldots, y_n) = I(\lambda y_1, \lambda y_2, \ldots, \lambda y_n)$.

Figure 3.1: An Example of a Lorenz Curve



4. *The Pigou- Dalton principle.* For every transfer of income $\delta > 0, I(y_1, \ldots, y_i, \ldots, y_j, \ldots y_n) < I(y_1, \ldots, y_i - \delta, \ldots, y_j + \delta, \ldots y_n)$ whenever $y_i \leq y_j$.

3.2.2 The Lorenz Curve and the Gini- Coefficient

The Lorenz curve is a diagrammatic representation of inequality that satisfies all the principles listed in the previous section. Let Y be an income variable, with belonging cumulative distribution function $F(y)$[3] and an existing mean μ. Then, the Lorenz curve can be defined as in Aaberge [2007] as

$$L(u) = \frac{1}{\mu} \int_0^u F^{-1}(t)dt, \quad 0 \leq u \leq 1 \tag{2}$$

where $F^{-1}(t)$ is the inverse of the income distribution function.

The Lorenz curve indicates the percentage of total income the poorest $100 \times u$ percentage of the population possess. For example, measuring the percentage of total income that the 20 per cent poorest possess, $u = 0, 2$. Further $L(0) = 0$ and $L(1) = 1$ will always hold, as zero per cent of the population will always earn zero per cent of total income, and hundred per cent of the population will always earn hundred per cent of total income. Moreover, the Lorenz curve will be linear from the point $(0, 0)$ to $(1, 1)$ for a completely equal income

[3] F can either be a discrete or a continuos distribution function. It is often observed as discrete, while a continuos F function can be used as a large sample approximation, as it makes derivations easier.

distribution, as the poorest $100 \times u$ percentage of population will earn exactly $100 \times u$ per cent of income. For any other income distribution the Lorenz curve will be convex, lying below to the right of the perfect equality line. The Gini- coefficient assigns a number to this representation of inequality, and is related to the Lorenz curve in the following way.

$$G = 1 - 2 \int_0^1 L(u)du \tag{3}$$

This means that the Gini- coefficient is one minus two times the area below the Lorenz curve. This is equivalent to two times the area between the Lorenz curve and the perfect equality line. The Gini- coefficient always lies in the interval $\{0, 1\}$, and inequality increases in this interval.

3.3 Challenges when Comparing Data Material Over Time

There are challenges when analyzing long term trends. The data material used in this thesis covers almost two centuries, and there are several sources of inconsistency and inaccuracy in this data material. It is important to be aware of these challenges when conducting the analysis. However, it will be argued that many of the challenges are possible to correct for, or will not affect the results. An overview of the historical data sources is given in Appendix B.

3.3.1 Data Material on Population and Industry Structure

The data on population development has been taken from the Norwegian population censuses for the whole time period from 1865 to 2012. From 1865 to 1950 there are only available data at some points in time, meaning that the population development between these points in time is not covered by the analysis. From 1951 to 2012 the population censuses are done yearly. There are no crucial consistency problems concerning the population data.

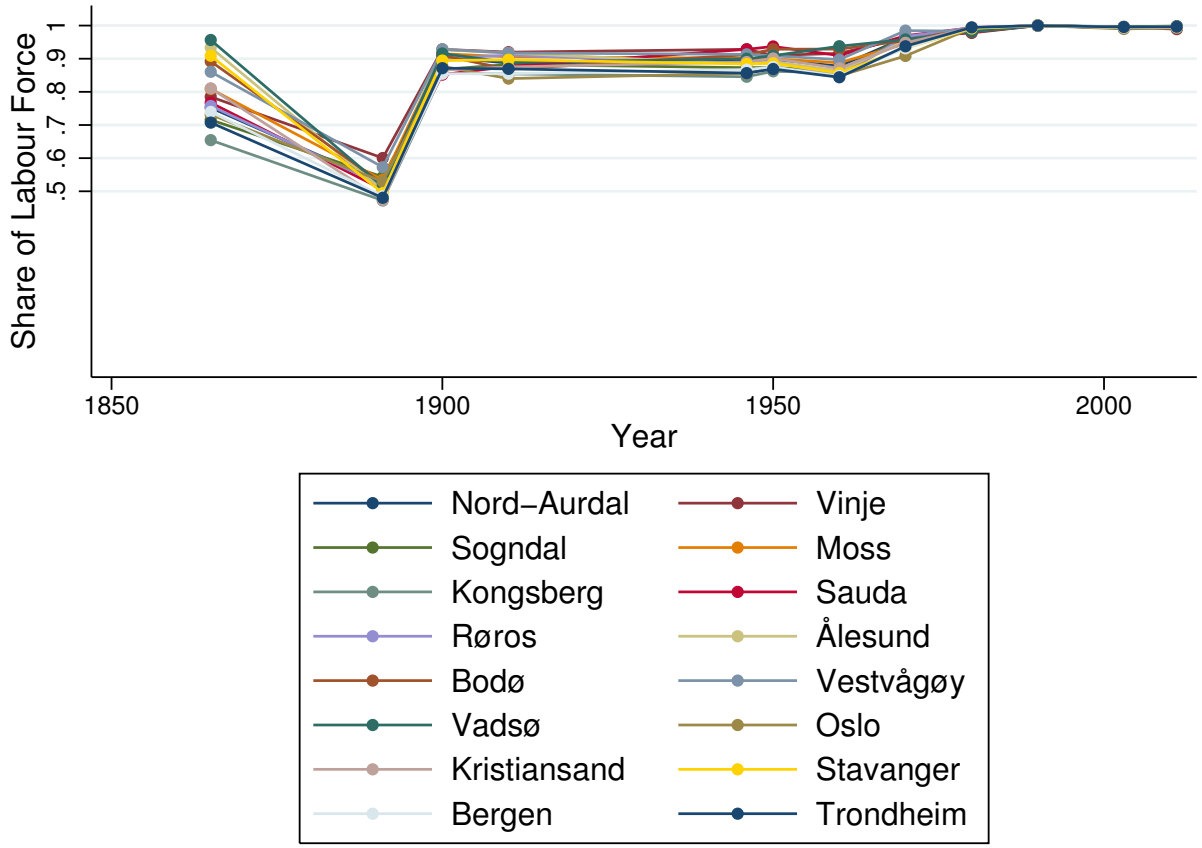
All data on industry structure is also taken from the Norwegian population censuses from 1865 to 1990. After this, data on industry structure is available electronically at Statistics Norway.

It is difficult to create a consistent time series for industry structure over such a long period, because this variable is more complex than the other variables investigated. There are two main issues. First, the categories describing in which industries the population is employed,

change from year to year. The second issue is that the part of the population captured by the population census changes over time.

The first issue is solved by creating four main industry groups. One group for primary industries, one for secondary industries, one for tertiary industries and one called "other industries".

Figure 3.2: The Share of the Labour Force Included in the Analysis



Because the industries that are included in the "other industries"-group change more than the other three groups, this group is excluded after collecting the data. The focus is put on the per cent of the population that is employed in the three remaining groups, as per cent of the total of these three groups. The share of the labour force that is included in the three groups that are studied in this thesis is shown in Figure 3.2. This share is quite high and stable over the period from 1900 to 2011, which indicates that the figures include

much information and that they are consistent over the period. But the share drops in 1891[4], and increase somewhat over the period after 1900. The definitions of the industries that are included in each of the three groups are principally the same during the whole period, but still one should study these figures with caution.

The second issue has been more challenging to solve. Particularly, female employment has increased significantly over the time period under study. In the first period of the analysis women typically worked at home, and were not registered as employed. When women entered the labour market they provided much of the same services as they did before. A solution to this could be to only consider male employment. The data material does not distinguish between male and female labour at all points in time. Therefore, the whole adult population will be considered, meaning that the growth in the service industries could be overestimated, along with female labour being reorganized and registered.

In addition, employment is measured related to industry in some years, and related to business in others. This will give somewhat different reporting. A detailed overview of the categorization of industries is outlined in Appendix C.

3.3.2 Data Material on Income and Varying Income Definitions

The historical data material on income may not be comparable to more recent data, as tax reporting and income definitions have changed over time. In addition, the data material is limited in the first three quarters of the time period under study and the tax sources dating far back in time may not be as reliable as the sources available today.

The figures on income are taken from the tax statistics, and gives only partial coverage of the income of the population. How much information that is included in these statistics have changed over time along with changes in tax regulations. There have been several tax reforms during the time period under study. In 1911 a tax reform, including a change to self- reporting of income, gave rise to a large increase in reported income. This is a sign of underreporting of income before 1911. Also in 1992 there was a large tax reform, involving reduced tax rates and a wider tax base, as explained in Gerdrup [1998]. Two tax reforms related to tax on dividends, in 2000/2001 and 2005/2006, also affect the information given in the tax statistics as explained in Aaberge and Atkinson [2010] and Aaberge et al. [2013]. It is not possible to create a completely consistent time series for income over such a long period,

[4]The reason is that people receiving pensions and other public transfers are included in the "other industries" group.

based on tax statistics. Still, tax statistics are the only sources that contains information on income dating far back in time.

Also the income definition changes during the period from 1859 up until today. From 1859 to 1966 the income data is taken from the municipal- and state tax statistics. This data is given in tables that show the number of tax units in each municipality and their total assessed income. The income definition is "assessed income", including the personal income of the population living permanently in the municipality[5]. Assessed income is defined in Statistics Norway [2005] as *"gross income less expenses for income acquisition, where gross income is earned income, unemployment benefits, pensions, business income and capital income".*

From 1967 micro data from the tax registry[6] is used. This data gives detailed information on individual income. The income definition used is "net income", defined as "ordinary income" minus certain deductions. "Ordinary income" is the modern income concept that is most comparable to "assessed income". The definition of ordinary income in Statistics Norway [2005] is; *"gross income less statutory income deductions such as minimum deduction and expenses for income acquisition, interest on debt, deficit in industry and mandatory contributions, pension premiums etc. Negative amounts are set to zero".*

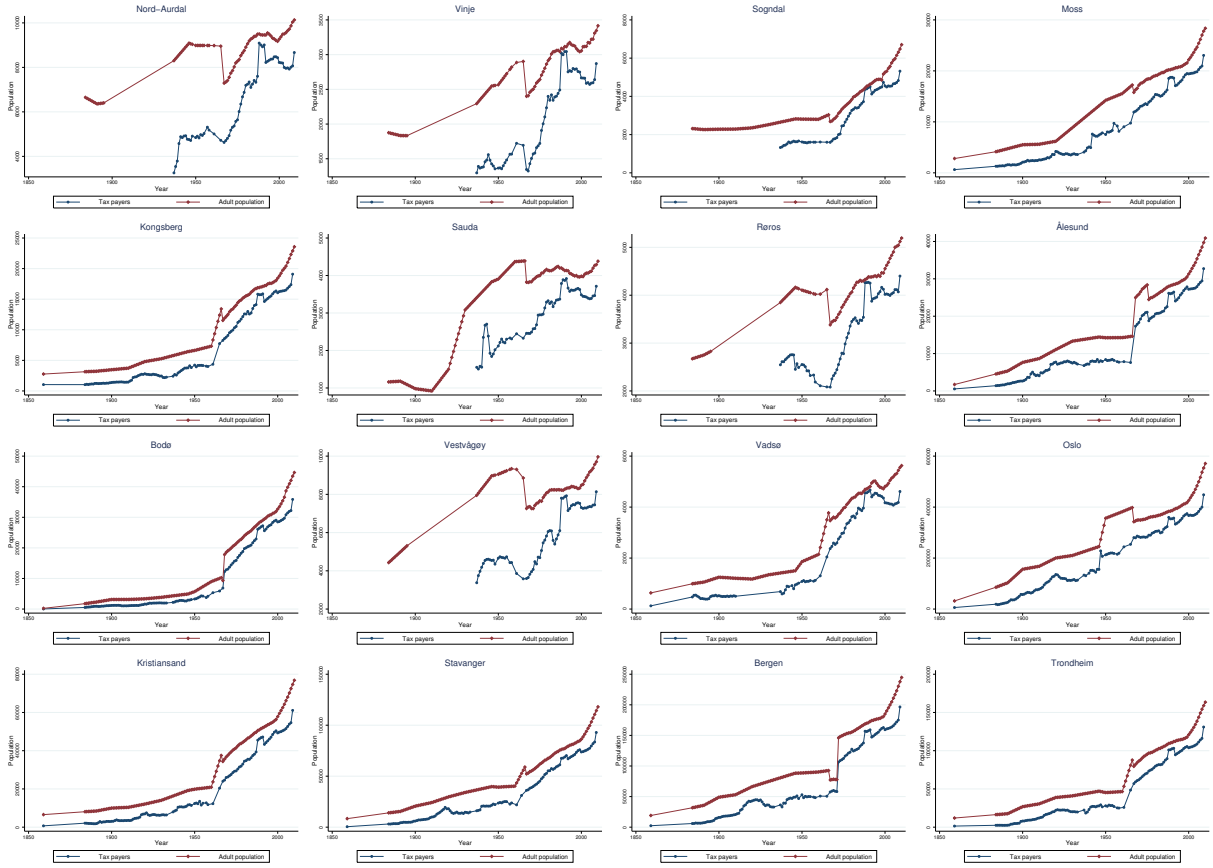
3.3.3 Estimating Mean Income

To get a measure of income development in the chosen municipalities that reflects welfare in the best way, figures on income relative to the population in the municipalities are needed. One option is to measure income relative to the number of tax payers that is registered in the tax statistics. Another option is to measure income relative to the adult population. The argument against using income per registered tax payer is that this population change with time and tax regulations. A larger and larger share of the population was included in the tax statistics over the time period, which would give an inconsistent time series in addition to overestimating mean income.

[5]Norwegian definition: "antatt inntekt" for "tilsammen innenbygds personlige skatteytere" and "forskottspliktige innenbygds personlige skatteytere".

[6]Norwegian definition: "Ligningsregisteret"

Figure 3.3: The Adult Population vs. Registered Tax Payers, 1859-2010



Source: NSD Kommunedatabase [2013c], Statistics Norway [2013b,c,d]

Another way of measuring mean income is to estimate the total adult population from 1859 to 2010, and measure income per adult. This will give a more consistent measure of the income development, as income will be measured relative to the same population over the whole period. The adult population can be found in the population censuses in this period, which is defined as the total population minus children below 15 years. Since figures on income of the adult population that is not included in the tax statistics is not available, their income level is assumed to be zero. This measure will therefore also be inconsistent, but will underestimate mean income. However, if the assumption is that the income of those not registered in the tax statistics was generally low, income per adult will give a pretty precise measure of mean income of the adult population. Then, also income per tax payer would be more consistent, but still a poor measure of welfare, since the part of the population with low income is excluded from the measure.

Figure 3.3 shows the adult population in each municipality compared to the registered tax payers in each municipality. There is a break in the series for the adult population in 1967, because the source of this measure change from population censuses before to micro-data after. There is also a break in the measure of tax payers in 1988, when tax payers with income below the lower limit for taxation becomes registered in the tax statistics. Otherwise, the discontinuities are related to changes of municipal borders, as shown in Appendix A. These breaks in population do not seem to create any inconsistencies in the measure of mean income that is presented in section 4.

These figures are included to show that the trend in population is similar for both measures, meaning that it is not of great importance for the results whether income is measured relative to the adult population or the registered tax payers, except for concerning the level of mean income. Still, one can see that the tax payers do become a larger and larger share of the adult population over time. In the further analysis, the measure used will be income per adult based on the assumption that this will be a better measure of welfare.

3.3.4 Estimating Income Inequality

Between 1884 and 1966 the income data is not given at an individual level. The data is given in tables, showing aggregated figures on income and the number of tax payers in each municipality. To provide a measure of income inequality, the population above 15 years have been divided into four income- groups to create three interior points on the Lorenz-curve. This method is taken from Atkinson [2012], and is similar to the one used in Lund [2012].

The first group is the adult population that is registered in the poverty statistics. As the population that was registered in the poverty statistics received social benefits, and could also have other income sources, it is likely that their actual income was above zero. Since it is likely that their income was low, and since it is not possible to give a precise measure of their income, it is assumed to be zero. This assumption might lead to an overestimation of income inequality.

The second group is the adult population that is not registered in the tax statistics or the poverty statistics. This means that their income is lower than the limit for taxation, but higher than the income of the poor. This population is called the NAP[7] population, in line with the notation in Lund [2012]. There are no figures on the income level of these individuals. Their income is therefore assumed to be 25 per cent of the income of the population that is

[7]Definition of NAP: Non assisted poor.

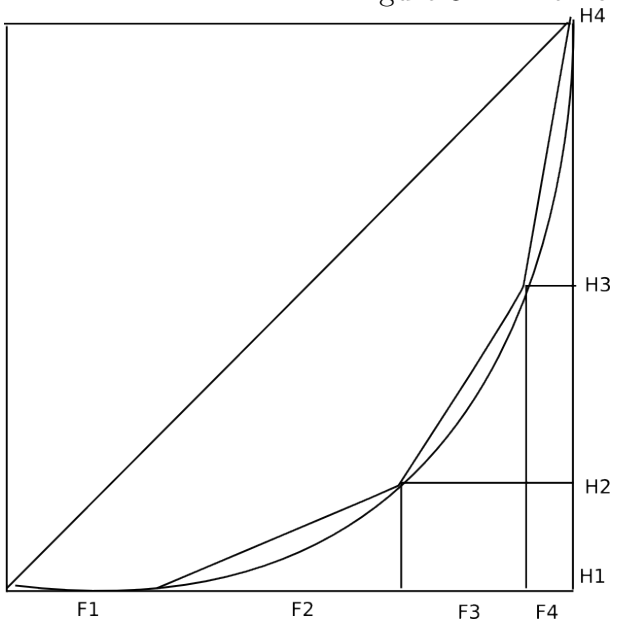
registered in the municipal tax statistics, which will make their income 20 per cent of the assumed total income. This assumption is based on a discussion in Gerdrup [1998]. The lack of information of the income of this group will make the income inequality measures inaccurate.

The third group is the population covered by the municipal tax statistics, but not by the state tax statistics. This means that the group is created by subtracting the aggregated income and number of tax payers registered in the state tax statistics in each municipality from the aggregated income and number of tax payers registered in the municipal tax statistics. The lower limits for taxation was generally lower for the municipal tax, meaning that a larger part of the population is included in the municipal tax statistics than in the state tax statistics. An underlying assumption when estimating this inequality measure is that those paying state tax is a part of those paying municipal tax, more specifically the part with the highest income. The observations for which this assumption clearly does not hold is disregarded in the data analysis. This applies in particular in the years between 1914 and 1922, when the registered income in the state tax statistics exceeds the registered income in the municipal tax statistics for some municipalities, while the number of tax payers is still lower than in the municipal tax statistics. In such cases it does not make sense to assume that the population that was registered in the state tax statistics was also included in the municipal tax statistics, as this would require that the income of those only covered by the municipal tax statistics was negative.

The fourth group is then the aggregated income and number of tax payers registered in the state tax statistics in each municipality.

The calculation of the income inequality measure will be similar to the calculation of the Gini-coefficient. By drawing line segments between the point $(0, 0)$, the three interior points on the Lorenz curve and the point $(1, 1)$, it is possible to approximate the Gini- coefficients. This is done by subtracting the area of the threesome and trapezes shown in Figure 3.3, from the area under the perfect equality line.

Figure 3.4: The Lorenz Curve, 1892-1955



The inequality measure one gets from this method is inaccurate as a result of several of the assumptions mentioned above. In addition, it will underestimate income inequality, because only a part of the income distribution is included. The income inequality within each group is not considered. Including income inequality within each group would give a convex shape of the line segments going through the points on the Lorenz curve, and would therefore give a larger area between this curve and the perfect equality line, as shown in Figure 3.4.

The calculation of income inequality is done using the following formula $G = 1-2\int_0^1 L(u)du = 1 - [F_1H_1 + F_2(H_1 + H_2) + F_3(H_2 + H_3) + F_4(H_3 + 1)]$

where G is the income inequality measure and $L(u)$ is the Lorenz curve.

The points in Figure 3.3 are the population shares and cumulative income shares of the four groups.

F_1 : The share of population that is registered as poor.

H_1 : The share of income of the poor, assumed to be zero.

F_2 : The share of population of NAP.

H_2 : The share of income of NAP and poor, assumed to be 20 per cent of total income.

F_3 : The share of population paying municipal tax, but not state tax.

H_3 : The share of income of the population paying municipal tax, NAP and poor.

F_4 : The share of population paying state tax.

$H_4 = 1$: The total share of income, hence the sum of the share of income of the population paying state tax, municipal tax, NAP and the poor.

From 1892 to 1955 income inequality is estimated using this data and these assumptions. It has been possible to do this estimation between 1892 and 1955, as this is when figures from all three sources are available. Since income figures in the municipal tax statistics only go back to 1937 for the rural municipalities, the estimation is only done between 1937 and 1955 for the rural municipalities.

This measure cannot directly be compared to the Gini- coefficients that are used after 1967, which are estimated on the basis of micro data. However, they are still useful, as they are the only measures that have been possible to create to study the development in inequality between 1884 and 1966, given the data available. They also have the same properties as the Gini- coefficient.

From 1967 there are detailed data on individual income in Norway. For this time period it is possible to estimate Gini- coefficients using data that covers the whole income distribution. The income measure used is still net income. There are some changes in reporting of income in the lowest income groups during this time period, particularly in the period from 1967 to 1988. In this period income of individuals earning less than the lower limit for taxation are not registered in the dataset for some years, while they are registered with zero income in other years. From 1988 until 2010 they are registered with their actual income. The errors caused by these changes in reporting from 1967 and onwards are, however, modest compared to the lack of data prior to 1966.

The Gini- coefficients are constructed by using the adult population, hence the population above 15 years of age. Only income above a threshold that corresponds to 20 000 in 1998 NOK is included when calculating the coefficients. This set of Gini- coefficients is consistent, because the changes in the reporting of zero incomes will not be taken into account. However, the lower part of the income distribution will not be considered.

3.3.5 Data Material on Poverty

The data material on poverty can be divided into two main categories. From 1886-1974 historical statistics on poverty in each municipality is used. From 2000 to 2012 modern social assistance data is used. The poverty measure is the poverty rate, hence the total number of people receiving social benefits because of poverty in each municipality, divided by the total population above the age of 15. Because of a change in the reporting in 1992, the figures from 2000 to 2012 are not directly comparable to the figures before this period. In addition, the measure may not be consistent over time, as many of the people that received poverty support in the beginning of the period will receive other types of support the later decades, as for example pensions.

3.3.6 Summary of Variables and Data Material

Table 3.3 gives an overview of the variables that are included in the data analysis and the measures that are estimated, given the data material available.

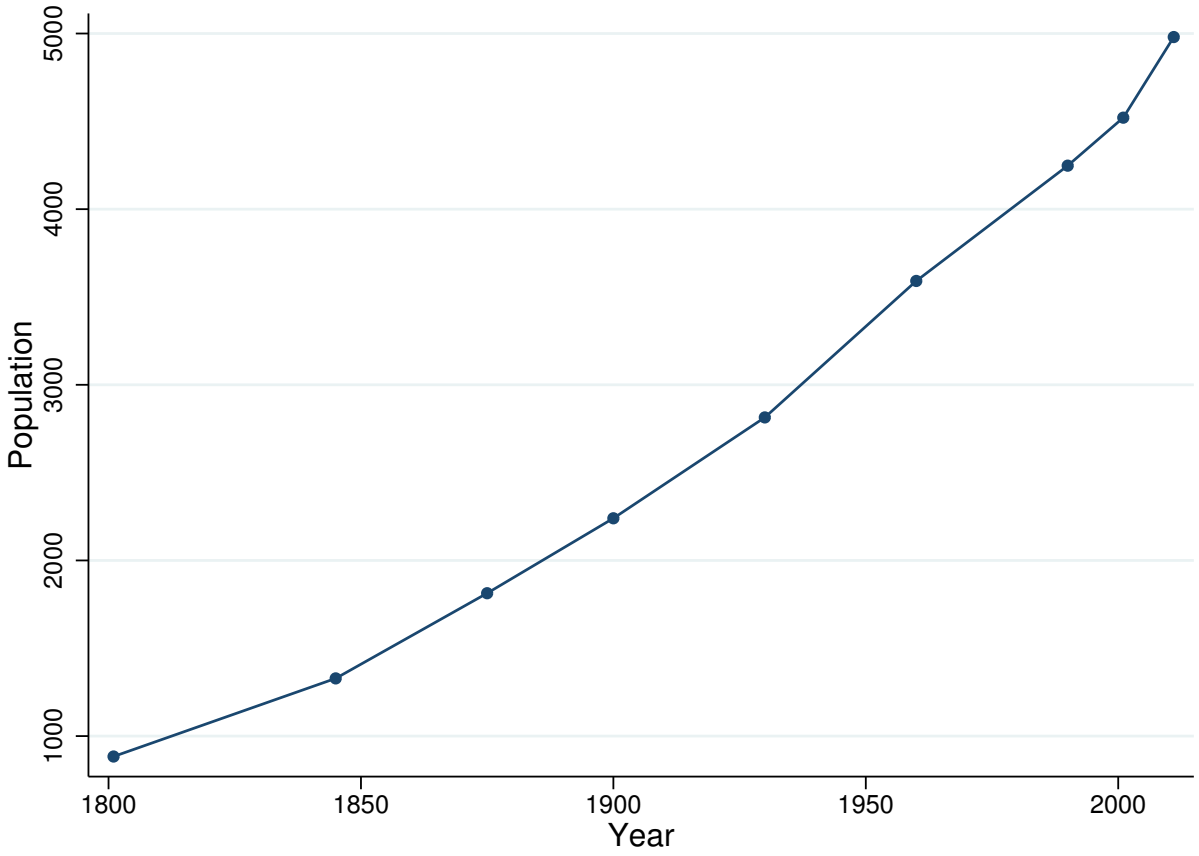
Table 3.3: Summary of the Chosen Variables to Describe Income Development

Variable	Historical data	Modern data
Population	Population 1865-2012	
Industry structure	Industry groups 1865-2011	
Economic growth	Mean income 1859-2010	
Income inequality	Three interior points at Lorenz curve 1884-1966	Gini- coefficients 1967-2010
Poverty	The poverty rate 1884-2010	

4 Data Analysis

In this section the results from the data material on the development in population, industry structure, mean income, income inequality and poverty in each municipality is presented.

Figure 4.1: Population in Norway 1801-2011, in thousands



Source: NSD Kommunedatabase [2013b]

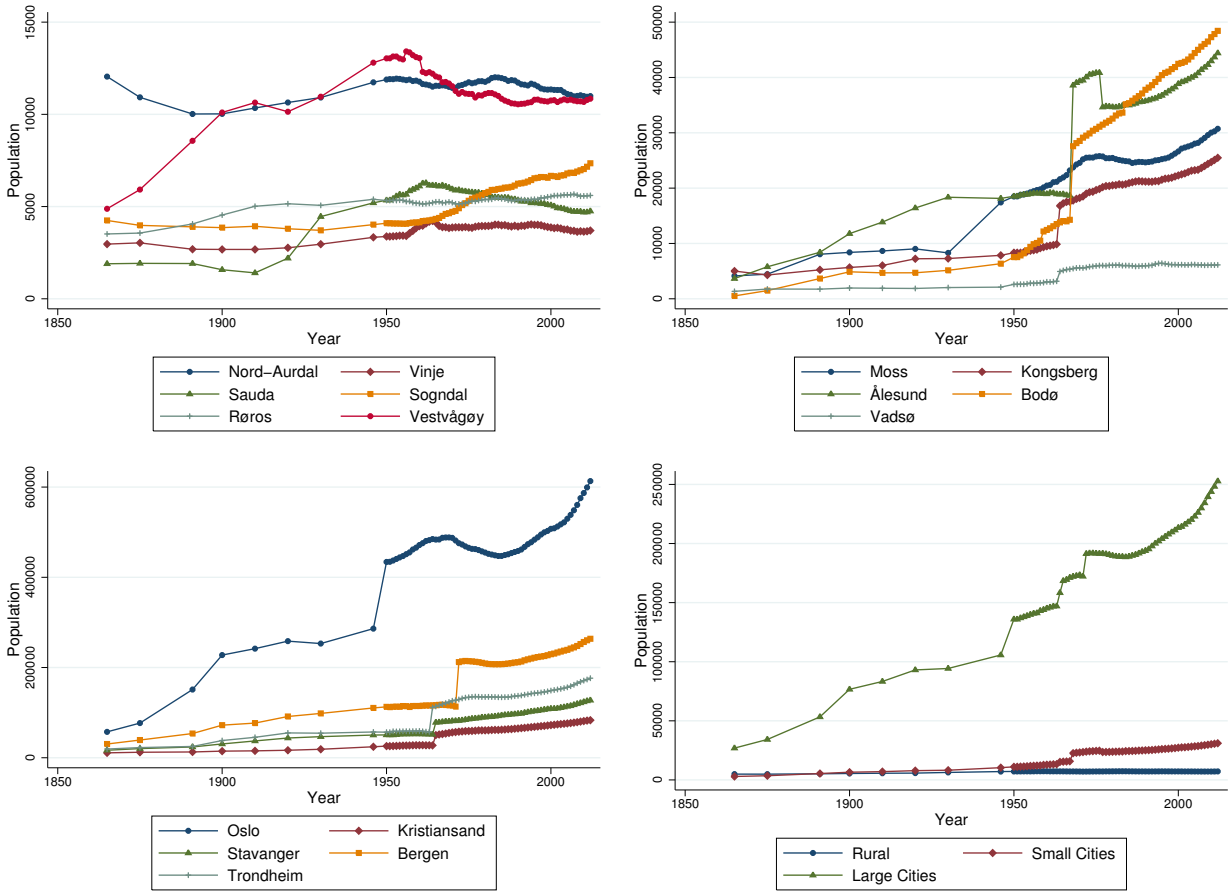
4.1 Population

Figure 4.1 shows the population development from 1801 to 2011 in Norway as a whole. The data is taken from the Norwegian population censuses in 1801, 1845, 1875, 1900, 1930, 1960, 1990, 2001 and 2011. The population trend in Norway has been increasing over the whole period, from below one million in 1801 to five million in 2011. In the first part of the period the population growth was driven by decreasing mortality rates due to better nutrition, housing and sanitary conditions, combined with high fertility rates, according to Hodne [1981]. The population growth rate have later decreased, which can both be due to decreasing infant mortality rates and the increasing female employment rate. According to

Sobye [2012] one of the main drivers of the the population growth in Norway during the last decades has been immigration.

When studying the population development at municipality level it is important to keep in mind that the municipal borders have changed over time. In the rural municipalities this will not lead to discontinuities in the population, because the whole group of municipalities presented in section 3 is considered. In the cities, on the other hand, there will be discontinuities at times where populated areas have been transferred from or to the city. This is because the population that is considered here is the population in each city as the borders were defined at that particular time, not the population in the city as defined today. In this way, a change of borders in populated ares at any point in time will lead to a change in the population equal to the population that is transferred.

Figure 4.2: Population 1865-2012 in the 16 Municipalities



Source: NSD Kommunedatabase [2013b]

The top left part of Figure 4.2 shows the population development from 1865 to 2012 in rural municipalities. The general trend is that the population increases moderately for each and all the municipalities, except for Nord-Aurdal. But the rural population growth is smaller than the population growth in Norway as such. In Nord- Aurdal, Vinje, Sauda and Sogndal the population decreased until the beginning of the twentieth century. The clearest decrease is in Nord-Aurdal. In Sogndal the decreasing population is less steep, but it keeps decreasing until the mid 1920s, which is longer than for the other three municipalities mentioned above. Sogndal has still experienced an increase in population through the whole period, as the population has increased steadily from the 1950s. One can also note that there is a clear decrease in population from about 1950 to 2012 in Vestvågøy, Sauda and Nord-Aurdal.

The top right part of Figure 4.2 shows the population development from 1865 to 2012 in small city municipalities. A small city is here defined as a city with a population below 50 000 in 2012. There is a clear upward trend in population during the whole time period for all cities. The discontinuities in population all coincide with changes of the municipal borders, and should not be considered when discussing population trends[8], as they are simply exogenous population transfers.

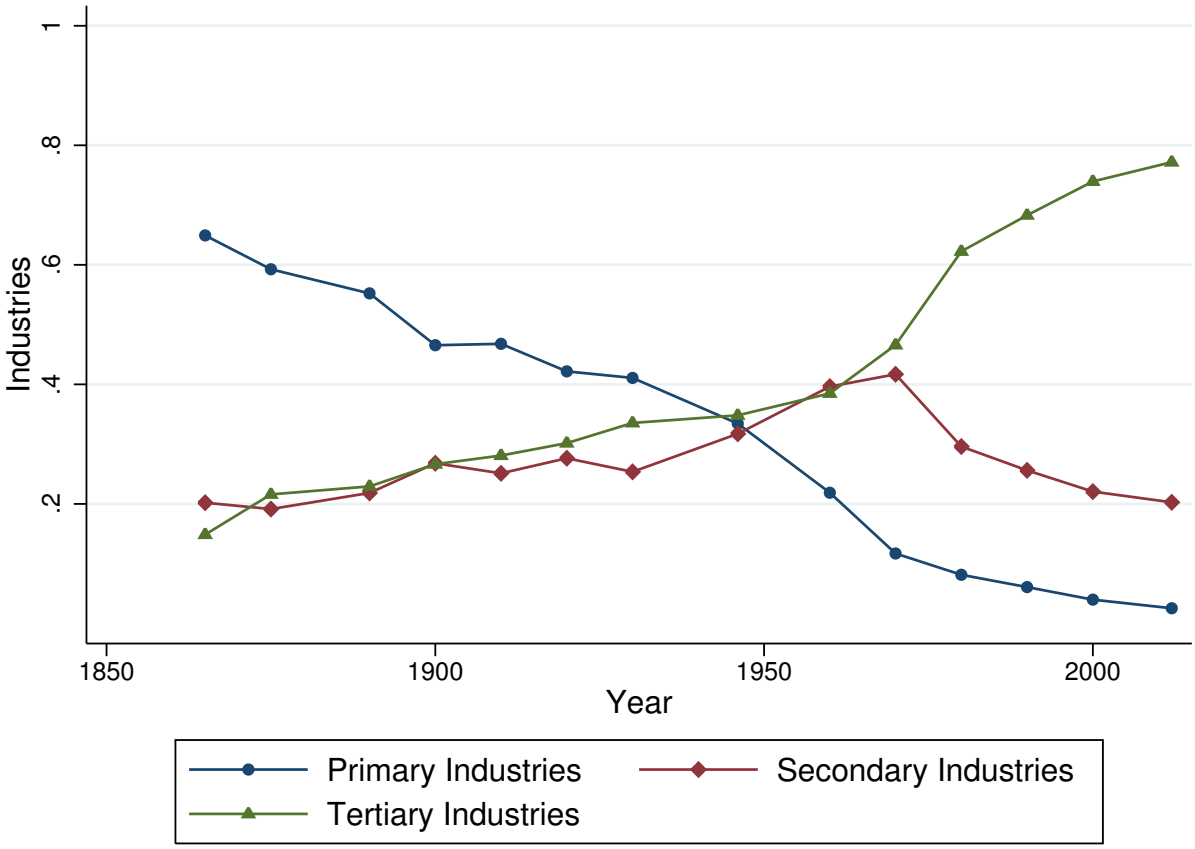
In large cities, which is here defined as the cities with a population above 50 000 in 2012, the trend of increasing population is even clearer than in small cities, as can be seen from the bottom left part of Figure 4.2. All large cities have more than doubled over the last 150 years. The discontinuities in population also here coincide with changes of municipal borders. The data material confirms that there has been an urbanization process over this period. The bottom right part of the figure shows the average development in rural-, small city- and large city municipalities, illustrating the disproportionally strong population growth in the cities compared to in the rural areas.

[8]See Appendix A for an overview of changes of municipal borders.

4.2 Industry Structure

The time series on industry structure is from 1865 to 2011. As explained in section 3, the 16 municipalities have been divided into four categories when presenting the results, to highlight differences and similarities in the development in industry structure across municipalities. The first category consists of the municipalities Nord-Aurdal, Vinje and Sogndal, traditional agricultural municipalities that have transformed into service sector municipalities. The second category is industrial municipalities, and includes Moss, Kongsberg, Sauda and Røros. The third category includes Ålesund, Bodø, Vestvågøy and Vadsø, that are all coast municipalities with large fishery and marine sectors. The last category consists of the largest cities, being Oslo, Kristiansand, Stavanger, Bergen and Trondheim.

Figure 4.3: Industry Structure in Norway 1855-2012

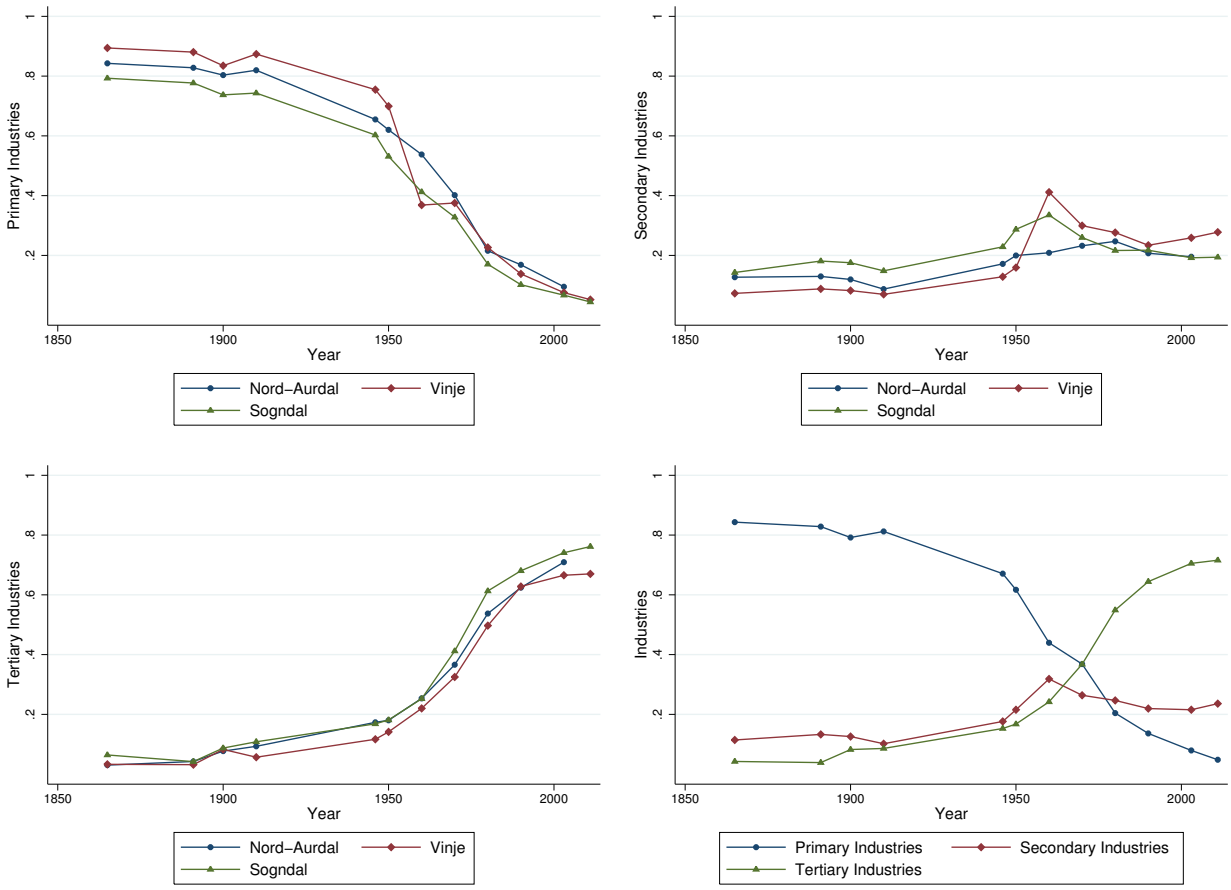


Source: NSD Kommunedatabase [2013a]

Figure 4.3 shows the industry structure in Norway as a whole, when using the same sources as has been used for each of the municipalities. This figure illustrates the structural changes that

has taken place in Norway over the last 150 years. In the end of the 1800s the industrialization process really started, and new technology gave rise to a shift of employment from primary- to secondary industries. There is a clear downward trend in the share of population employed in primary industries from above 60 per cent in 1865 to less than 10 per cent in 2011. After around 1960, the service industries took over as the most important industries, and after this the shift of employment was from both primary- and secondary industries to tertiary industries. The share of population employed in tertiary industries increased from below 20 per cent in 1865 to almost 80 per cent in 2011. The share of population working in secondary industries was at around 20 per cent in 1865, as well as in 2011, but it increased until the 1970s, for then to decline again.

Figure 4.4: Industry Structure in Agriculture Municipalities, after industries 1865-2011



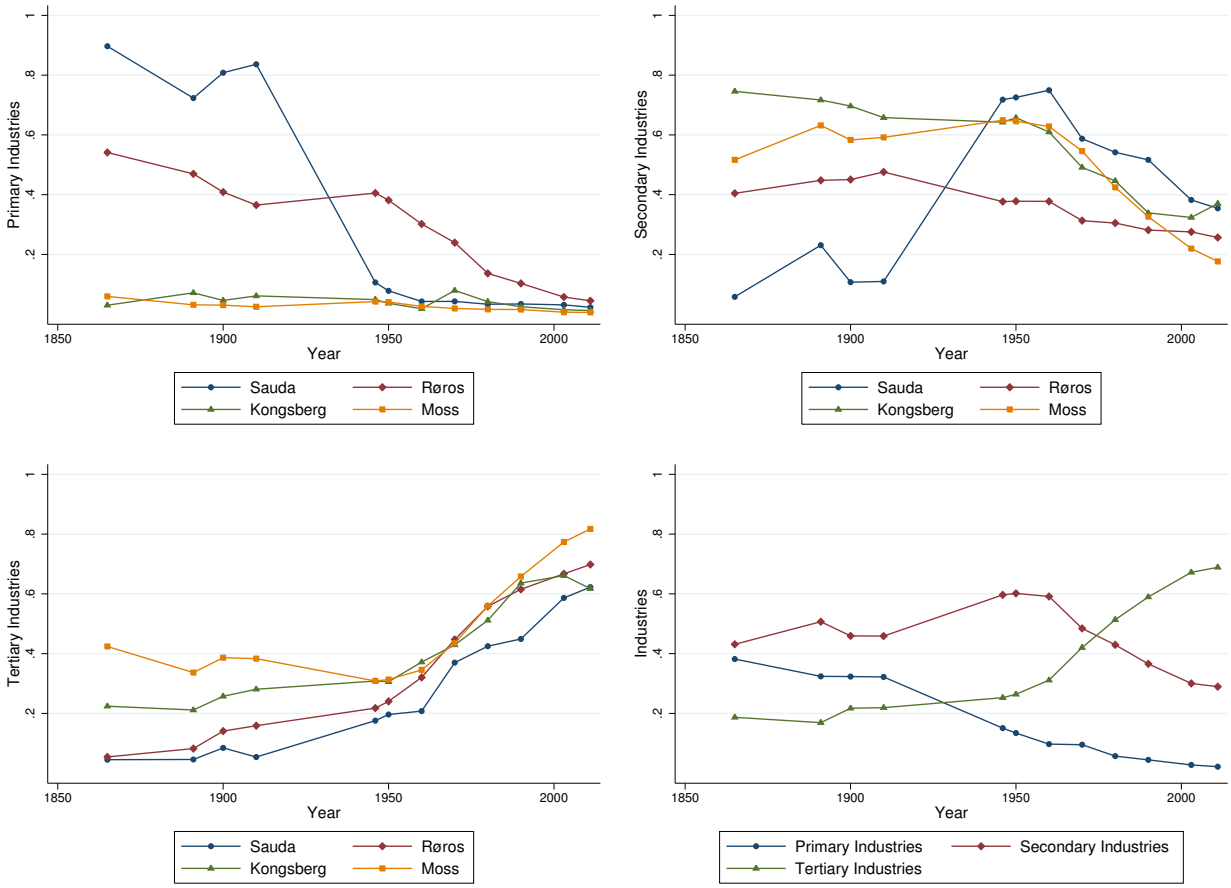
Source: NSD Kommunedatabase [2013a]

Figure 4.4 shows the change in industry structure from 1865 to 2011 in the municipalities that traditionally was very dependent on agriculture. The top left part of the figure shows the per cent of the population working in primary industries, the top right part shows the

same for secondary industries, and the bottom left part for tertiary industries. The bottom right part shows the average percentages in the three municipalities. The industry structure in the agricultural municipalities is similar in all three municipalities over the whole period. The per cent of the population working in primary industries has declined dramatically, from above 80 per cent in 1865 to below 10 per cent in 2011, while the per cent of the population working in secondary industries has been quite constant. The per cent of population working in tertiary industries has then increased accordingly. The average per cent of population in these municipalities working in secondary industries was 30 at the highest, compared to 40 per cent in Norway as such. The secondary industries never became as important in the traditional agricultural municipalities as in the industrial municipalities and in other Norwegian cities. Much of the movement in employment has gone directly from primary industries such as agriculture, to tertiary industries such as public services.

Figure 4.5 shows the same percentages as Figure 4.4, but for the group of municipalities where a relatively large share of the population was or is employed in secondary industries. The industry structure was not similar between these municipalities in in 1865, but it has converged over the period towards 2011. Especially the development in Sauda stands out before 1950, as the industrialization process took place at a later point in time than in the rest of the municipalities. In the remaining municipalities the secondary industries was important already in 1865.

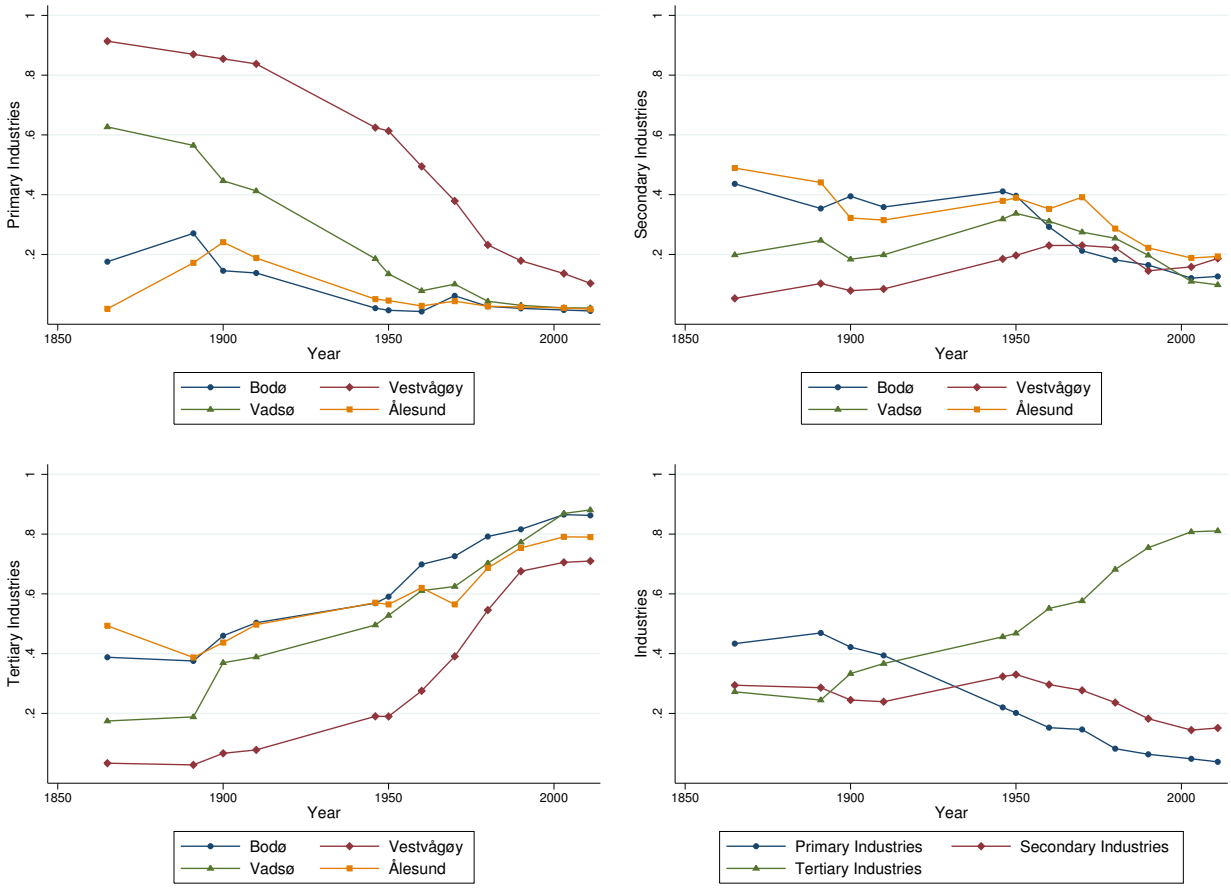
Figure 4.5: Industry Structure in Industrial Municipalities, after industries 1865-2011



Source: NSD Kommunedatabase [2013a]

The share of the population working in primary industries was constant and low in Kongsberg and Moss over the period, while it decreased from above 50 per cent in Røros, and about 90 per cent in Sauda, to the low level in 2011. The share working in secondary industries was quite high in Moss, Kongsberg and Røros in 1865, but declined over the period. Sauda went through an industrialization process from the 1900s to the 1950s, and the share working in secondary industries increased from 10 per cent in 1865 to almost 80 per cent in 1950. The share working in tertiary industries has increased in all the industrial municipalities, like in the traditional agriculture municipalities.

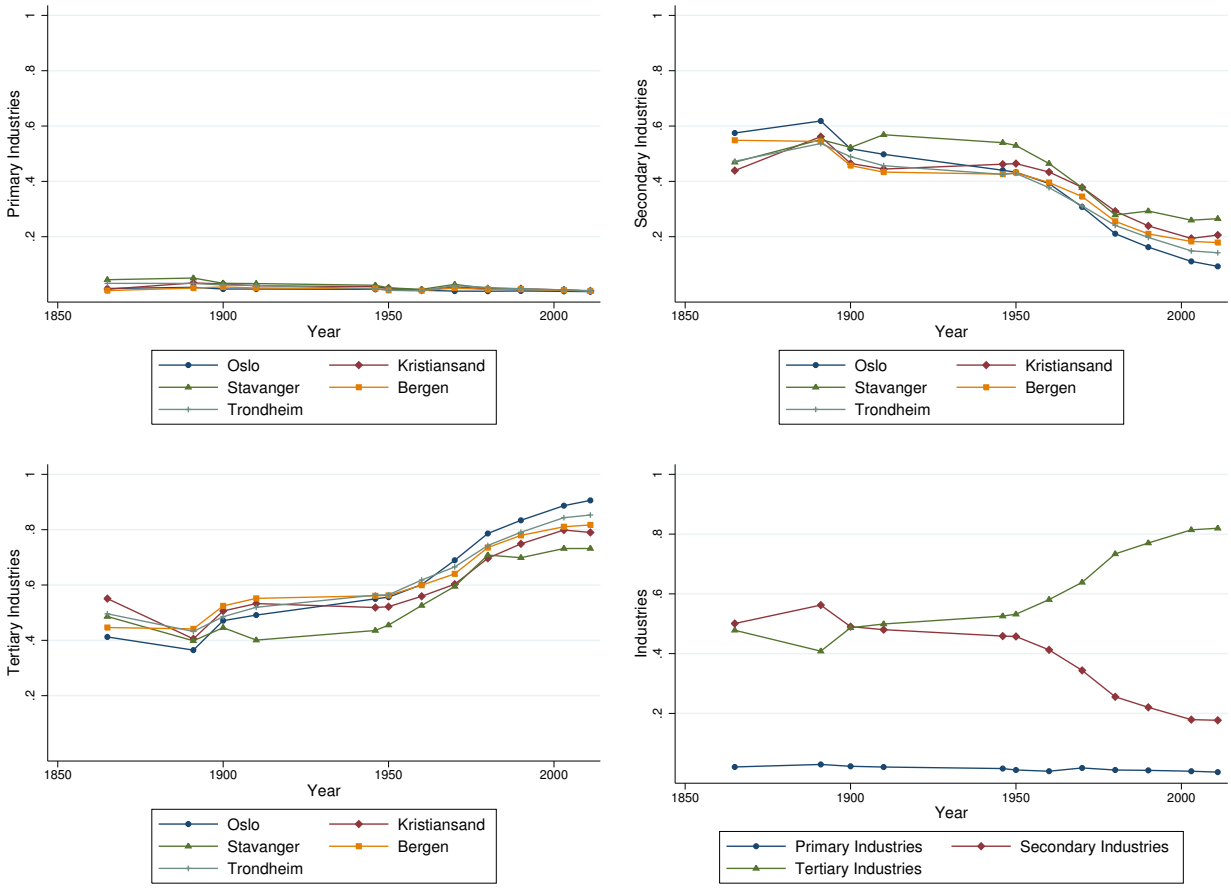
Figure 4.6: Industry Structure in Coast Municipalities, after industries 1865-2011



Source: NSD Kommunedatabase [2013a]

Figure 4.6 again shows the per cent of the population working in primary-, secondary- and tertiary industries, but this time for the coast municipalities. The share working in primary industries has declined, particularly in Vadsø and Vestvågøy. The share working in secondary industries has also declined in Bodø and Ålesund, while it has remained quite constant in Vadsø and Vestvågøy. The share working in tertiary industries has increased in all municipalities to around 80 per cent on average in 2011. This category of municipalities is similar to the agricultural municipalities in that secondary industries never became important, and the employment mostly moved directly from primary industries to tertiary industries. But the development in industry structure has not been similar for all four municipalities over the whole period. The industry structure was quite different between the municipalities in 1865, but converged towards 2011, as was also the case for the industrial municipalities.

Figure 4.7: Industry Structure in Large Cities, after industries 1865-2011

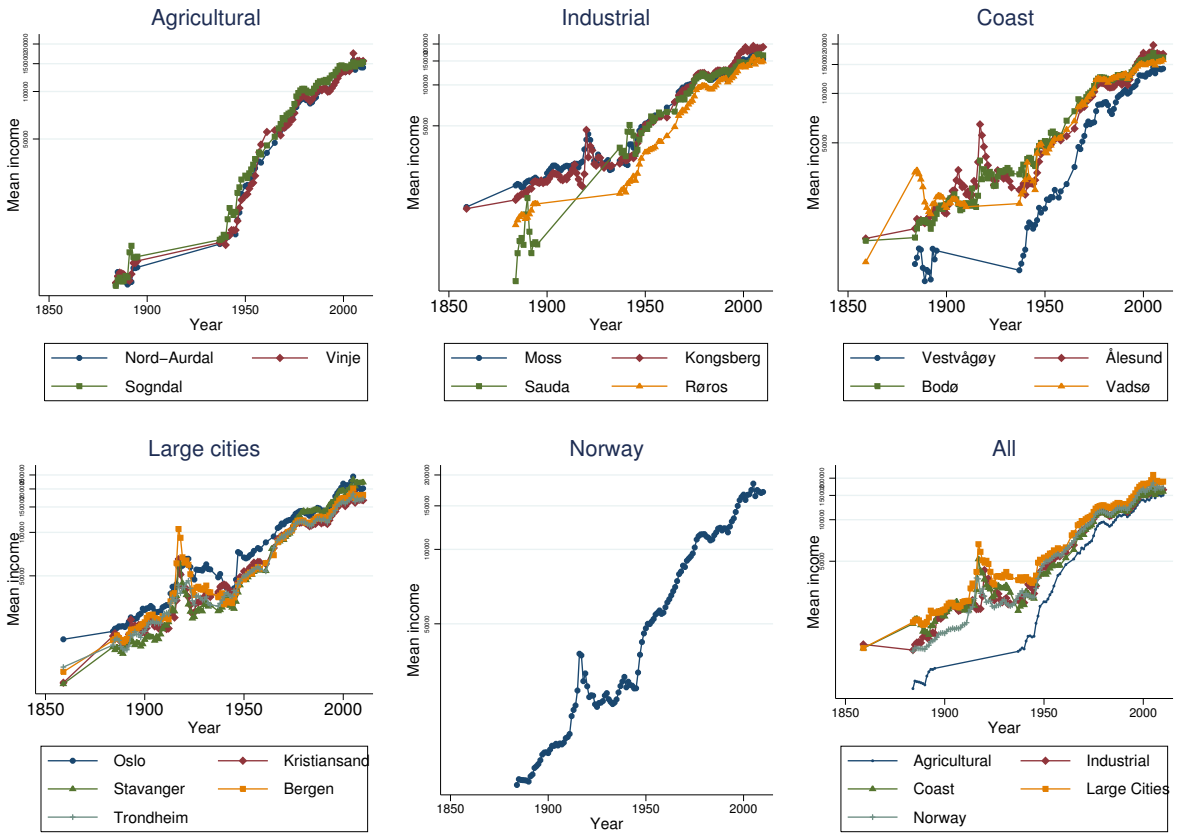


Source: NSD Kommunedatabase [2013a]

As can be seen from Figure 4.7, the similarity in development in industry structure between the largest cities in Norway is striking. Focusing on the primary industries, there is a different picture in large cities than in other municipalities. In large city municipalities the per cent of the population working in primary industries was low even in 1865, and has been quite constant until 2011. In secondary industries it has declined from between 40 and 60 per cent in 1865 to between 10 and 30 per cent in 2011. The share working in tertiary industries was higher than in the other groups in 1865, and it has grown from between 40 and 60 per cent to between 70 and 90 per cent in 2011. In many ways it thus seems like the development in industry structure started earlier in the large cities than in the rest of the municipalities.

4.3 Income Development

Figure 4.8: Mean Income 1859-2010



Source:Statistics Norway [2013b,c,d], NSD Kommunedatabase [2013c]

This section gives a description of the development in mean income, as defined in section 3. The income figures are given in constant prices, meaning that they are CPI[9] adjusted, using 1998 as the base year and Norges Bank [2013] as source for figures on the CPI over time. Figure 4.8 shows the development in mean income in each municipality. Mean income in Norway as a whole is also included, using the same income sources as the ones used at municipality level. In Figure 4.8, mean income is presented on a logarithmic scale to better show the development over the whole period. Since income growth has been close to exponential, the logarithmic representation is close to linear.

The top left graph in Figure 4.8 depicts the development in mean income in the agricultural municipalities. The top middle graph shows the same for the industrial municipalities, and

[9]CPI: The Norwegian consumer price index, meant to reflect the general price level in Norway.

the top right graph for the coast municipalities. The bottom left graph shows the income development in the large cities, and the middle bottom graph shows the development in Norway as such. The bottom right graph shows the average development in each of the five other graphs.

In the agricultural municipalities the development in mean income has been similar for all three municipalities, as has the development in industry structure. These municipalities started with a low level of mean income compared to Norway as such, but have experienced a stronger growth in mean income, leading to a level of mean income close to the rest of the municipalities in 2010. Between 1895 and 1937 there are no available data on income for the rural municipalities, meaning that the income development in this time interval cannot be analyzed.

The industrial municipalities have experienced a convergence in mean income for the municipalities within the category. Røros and Sauda started out with a lower level of mean income than in Moss and Kongsberg, as well as a higher share of population employed in primary industries, seen from the previous subsection. As the share of employment in primary industries declined in Røros and Sauda, towards the share in Moss and Kongsberg, their mean income increased towards the level of mean income in Moss and Kongsberg.

There is also a convergence in mean income over the time period for the municipalities in the coast category. Also here, it is Vadsø that starts out with a lower level of mean income than the rest of the municipalities. This is also the municipality where the highest share of the labour force is engaged in primary industries in the beginning of the period. As this share declines, mean income converges towards the rest of the coast municipalities.

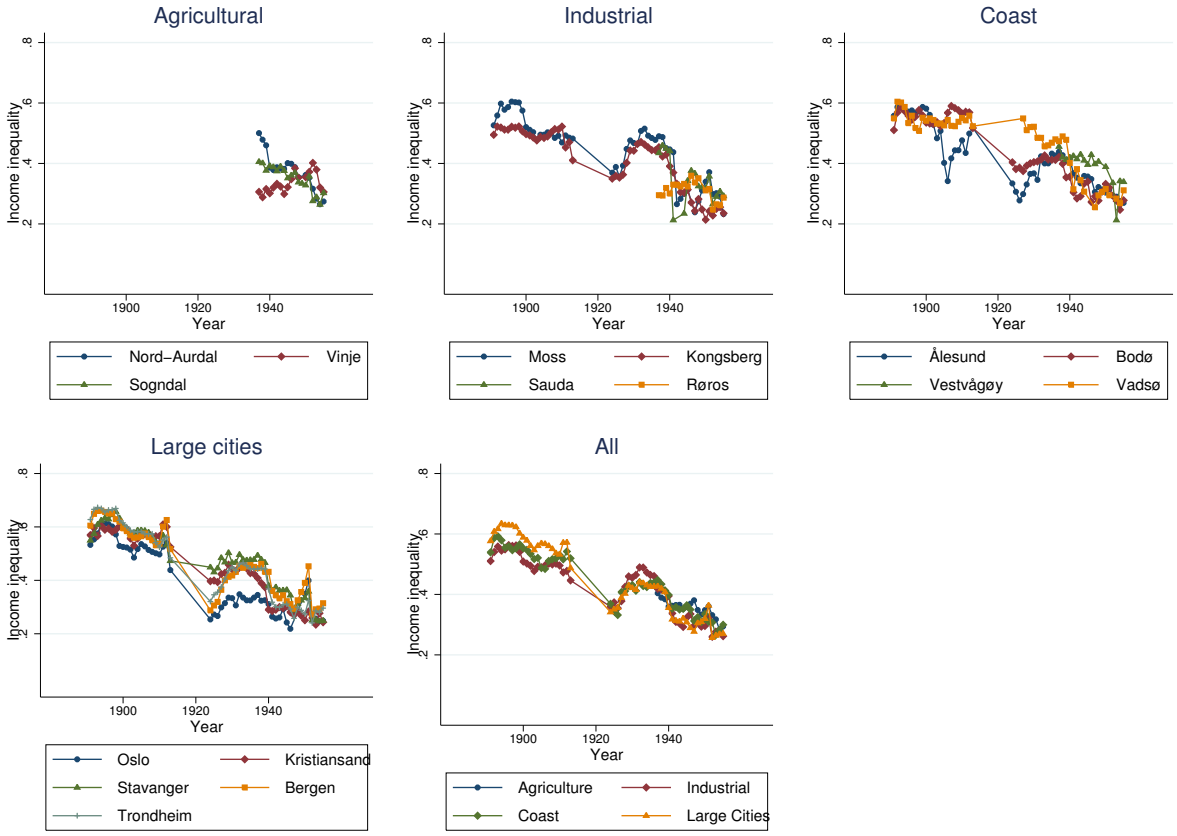
The income development in the large cities is similar over the whole period. The level of mean income is higher than in Norway as such, especially in the beginning of the period. As already suggested, the level of mean income is more similar between all municipalities in 2010.

4.4 Income Inequality

4.4.1 Income Inequality 1884-1966

Figure 4.9 shows income inequality measured by the approximated Gini-coefficient as explained in section 3.3.4. The figures for the city municipalities are between 1892 and 1955 and for the rural municipalities between 1937 and 1955.

Figure 4.9: Income Inequality, 1892-1955



Source: Statistics Norway [2013b,c,e], NSD Kommunedatabase [2013c], Propositions [1892-1936]

It is difficult to separate the development in income inequality in each municipality from each other. The development seems quite similar between municipalities within each group, as well as between the different groups of municipalities. In addition, there are only data for a few years in the rural municipalities, meaning that the development in agricultural municipalities, and the average development in coast- and industrial municipalities cannot be identified before 1937.

What can be seen is that the trend is a decrease in inequality before the 1920s, and a period of increasing inequality thereafter. From the 1940s, income inequality has been quite low. There are signs that income inequality was higher on average in the large city municipalities in the beginning of the period, where also mean income was higher, and the share of population employed in primary industries was lower. In 1955, however, income inequality is quite similar between all municipalities. It does not seem to be a clear convergence in income inequality between the municipalities within the coast category and between the municipalities within the industrial category, as was clear regarding industry structure and mean income.

Again, it is important to emphasize that rural municipalities are not included in these results before 1937, meaning that it is not possible to conclude that income inequality was generally higher in the city municipalities than in rural areas. In addition, this income inequality measure builds on several assumptions which may not be true, making these results inaccurate.

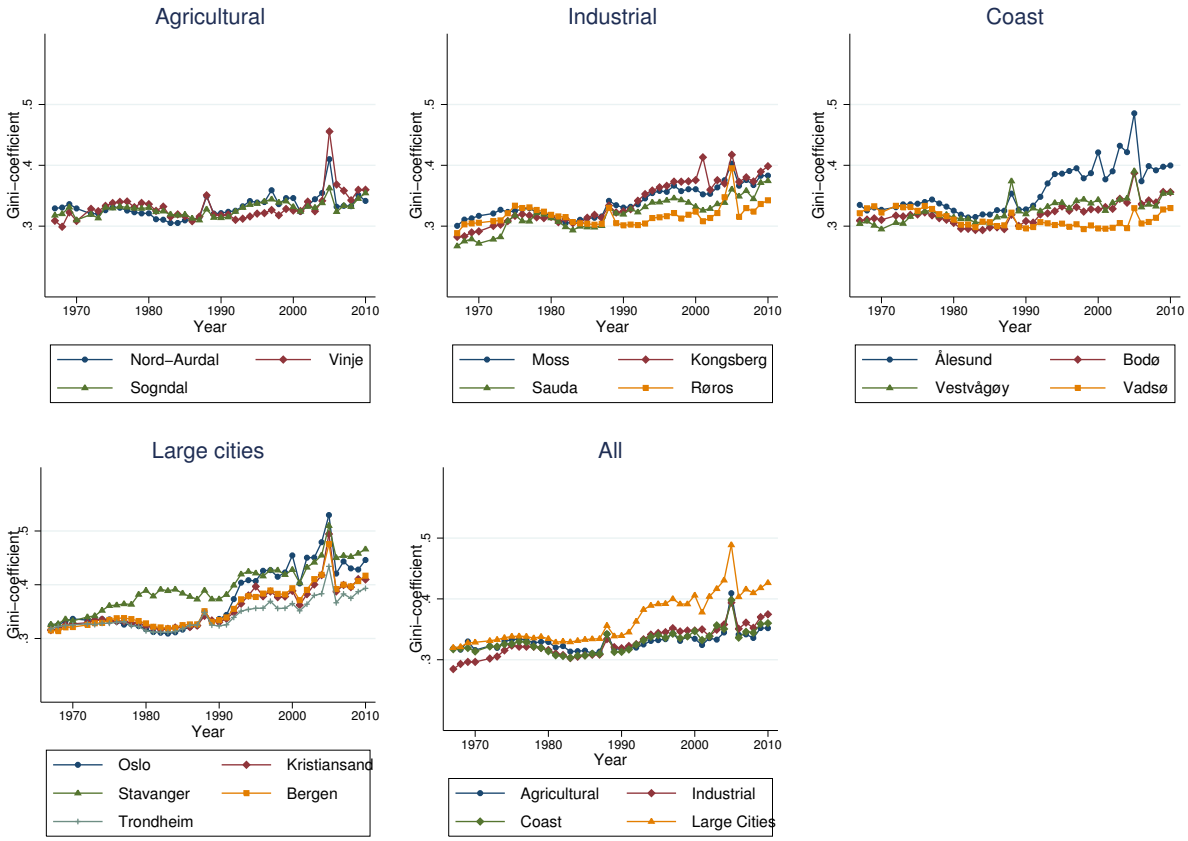
4.4.2 Income Inequality 1967-2010

Figure 4.10 shows the Gini- coefficients for all municipalities from 1967 to 2010. An upward jump in income inequality can be seen in 2000 and 2005. These jumps are connected to changes in tax- regulations as explained in section 3.3.2.

This trend is similar for all municipalities, with stable and low Gini- coefficients between 1967 and 1990. The Gini-coefficients were around 0.3 during this period, and were also similar between the municipalities within each category, as well as between the categories. The situation of low and stable income inequality continued until the late 1980s.

From about 1990 the Gini- coefficients started increasing. This result is in line with the findings of Aaberge and Atkinson [2010] and Solbu [2009] for Norway as a whole. In the agricultural municipalities the increase in income inequality is modest, and the development is similar for all municipalities within this category. In the rest of the municipalities, however, one can observe that there was a divergence in income inequality between 1990 and 2010. The divergence in income inequality is especially present for the coast municipalities, as income inequality rises more in Ålesund than the other coast municipalities, and in the large city municipalities. The difference in income inequality between each category also increases, as the increase in income inequality is greater for the large city municipalities, and modest for the agricultural municipalities.

Figure 4.10: Gini- Coefficients, 1967-2010

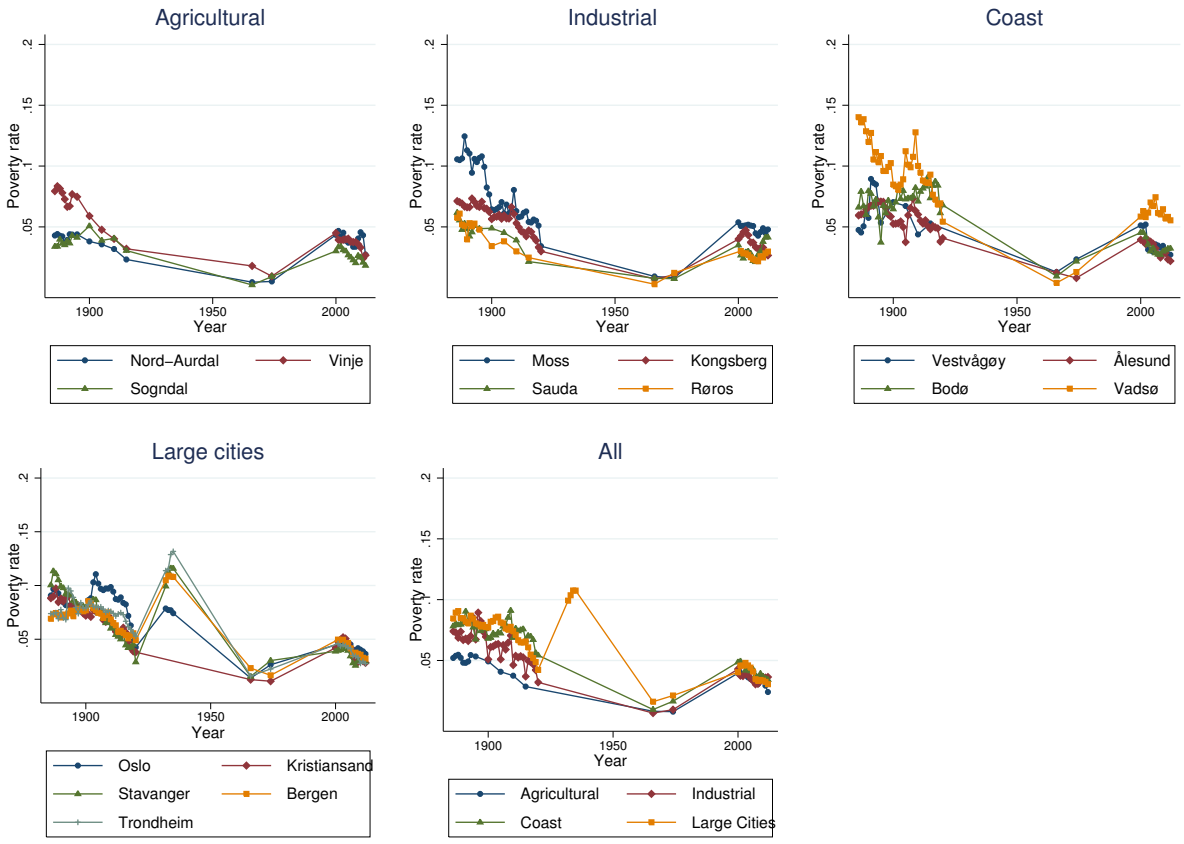


Source: Statistics Norway [2013d]

These results are somewhat surprising, as there was a convergence in industry structure for the municipalities within the industrial- and coast- category, in addition to a convergence in industry structure between each category. The same was true for mean income. In the 1990s the economic conditions had stabilized and was quite homogenous in all municipalities. This means that the increase in income inequality, and the divergence in income inequality between municipalities is likely to be caused by something else than industry structure and mean income. As emphasized in previous literature, the increase in income inequality is largely driven by an increase in the top income shares, which is further related to a financial deregulation in 1984 and the tax reform in 1992. It seems like these conditions affected income inequality in the large cities to a greater extent than in the agricultural municipalities.

4.5 Poverty

Figure 4.11: The Poverty Rate 1886-2010



Source: Statistics Norway [2013e,a], NSD Kommunedatabase [2013c]

Figure 4.11 shows the share of the population registered in the poverty statistics, also called the poverty rate. There is a steady decline in the poverty rate in the agricultural municipalities, as well as in the industrial- and coast municipalities until 1967. The reason for the lack of variability after 1920 is the lack of data between 1920 and 1967, except for in Bergen, Oslo, Stavanger and Trondheim, where there are data from 1932 to 1935 showing an increasing poverty rate from 1920 to 1935. This means that it is not possible to analyze the development between 1920 and 1967 for the remaining municipalities. What can be observed is that the poverty rate is lower in 1967 than in 1920. It is, however, likely that this rate rose in the 1930s, during a period of low growth and high unemployment, also in the remaining municipalities.

In the beginning of the period a large share of the population registered as poor would today receive other types of benefits, Statistics Norway [1974]. One example is elderly, who previously received social benefits. In the period from 1886 to 1967 the welfare state expanded, providing pension benefits to elderly who earlier were registered as poor. This means that a part of the drop in the poverty rate can be explained by increased pension benefits, as well as other social benefits that came into place during this period.

Further, there was a small increase in the poverty rate from 1967 to 1974 in most municipalities, and an even larger increase in this rate from 1974 to 2000 in all municipalities. From 2000 to 2012 there was a small decrease. In 2012 the poverty rate was lower than in the beginning of the period for all municipalities, meaning that the long-term trend has been downward sloping. In addition the poverty rate is more stable in the end of the period. The poverty rate converged between municipalities to some extent. This indicates that the divergence in income inequality after 1990 is largely related to the mid and top part of the income distribution, not to the bottom.

5 Discussion

Two questions were raised in the beginning of this thesis. These questions have been answered implicitly throughout the thesis, but this section will give clearer and more explicit answers, by relating the results from the data analysis to the inverted U hypothesis and other relevant literature. The first question was:

> *Has income inequality in Norwegian municipalities been rising or falling over the last 150 years?*

This question is discussed for the municipalities under study by investigating the average estimates on income inequality over time. To explain the development, the question is also related to the development in other variables from the data analysis, the previous literature on income inequality in Norway as a whole and Kuznets [1950, 1955] inverted U hypothesis. The second question that was raised was:

> *Has the industry structure in Norwegian municipalities converged over the last 150 years? If so, has this affected income growth or income inequality?*

When answering this question, the focus is more local and set on differences between municipalities, as oppose to in the answer to the previous question, where the focus was on the average development over time.

5.1 Has Income Inequality in Norwegian Municipalities Been Rising or Falling Over the Last 150 Years?

According to Kuznets [1950, 1955], the process of economic development, industrialization and urbanization as seen in Norway over the last 150 years, is characterized by an inverted U pattern for income inequality. As explained in section 2.1 income inequality is then first expected to increase, for then to decline.

5.1.1 Income Inequality Over Time

Table 5.1: Mean of Income Inequality in the 16 Municipalities

Year	Mean Income Inequality		
	City Municipalities	Rural Municipalities	All municipalities
1892	0.588		
1900	0.562		
1913	0.489		
1924	0.352		
1930	0.431		
1940	0.379	0.374	0.377
1950	0.310	0.344	0.323
1955	0.268	0.300	0.280
Year	Mean Gini- coefficient		
1967	0.315	0.302	0.310
1980	0.325	0.322	0.324
1990	0.328	0.316	0.324
2000	0.381	0.334	0.363
2010	0.400	0.355	0.383

Table 5.1 shows whether this development in income inequality can be seen in the 16 municipalities investigated in this thesis. The table shows the mean income inequality in the 16 municipalities from 1892 to 2010. From 1892 to 1955 the income inequality measure from section 4.4.1, based on three interior points at the Lorenz curve, is used. After 1967 the income inequality measure is the Gini-coefficient from section 4.4.2. The municipalities are divided into city- and rural municipalities. Due to that there are no municipal tax data for the rural municipalities before 1937, only figures on the city municipalities are included in the time span from 1892 to 1937.

Since the income inequality measure from 1892 to 1955 is not comparable to the Gini- coefficient from 1967 and onwards, these periods must be studied separately. It is clear from Table

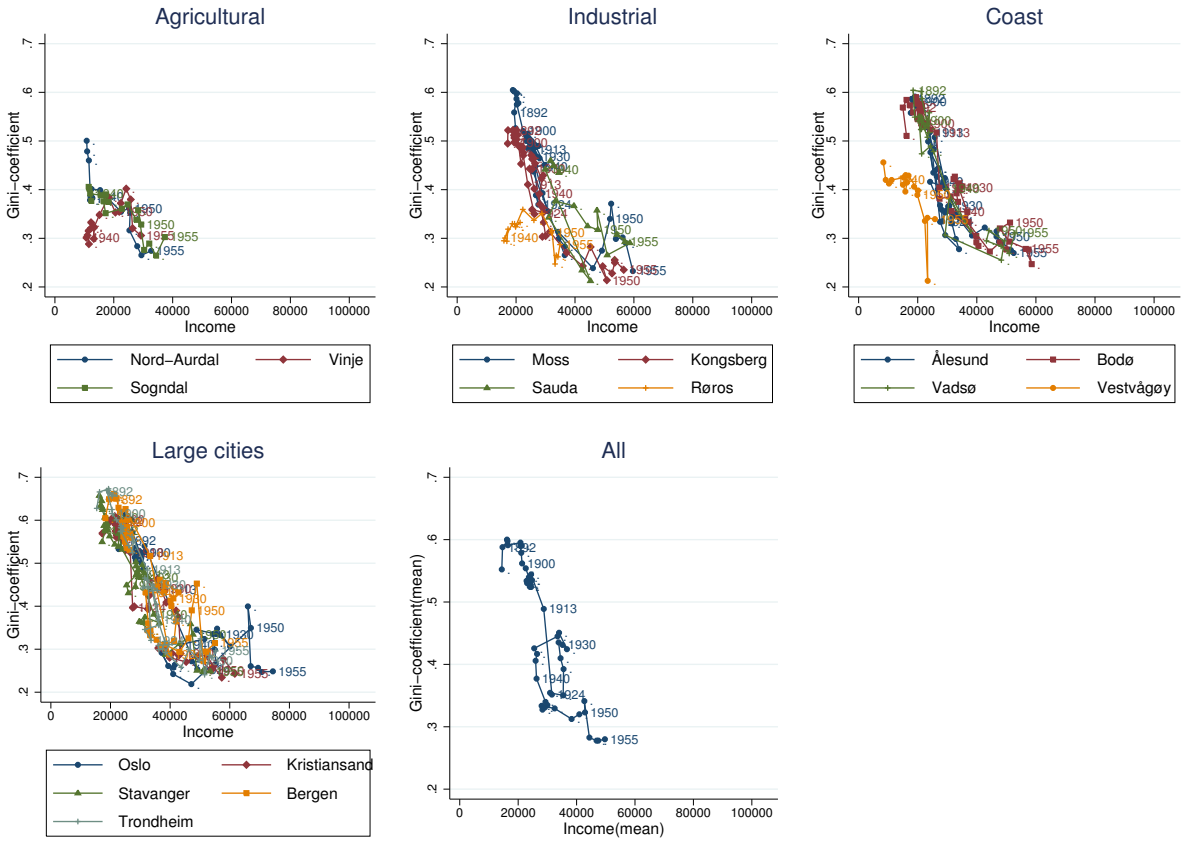
5.1 that the average income inequality in the municipalities decreases in the first period, and increases in the last period, especially in the city municipalities. It is not possible to conclude whether or not income inequality has increased or decreased over the period as a whole, since these two measures cannot be compared to each other. Still, the decline in the measure of income inequality for the cities between 1892 and 1955 is 0.320, which is more than 54.4 per cent. The increase in income inequality in the cities after 1967 is only 0.085 or 27.0 per cent. If these measures were comparable, the recent increase in income inequality would be significantly smaller than the decline in income inequality between 1892 and 1955 in the city municipalities, hence one would conclude that income inequality declined over the period as a whole in these municipalities.

If we assume that the decline in income inequality between 1892 and 1955 was of the same size for the rural and urban municipalities, and since the recent increase in income inequality has been greater in the city municipalities than in the rural municipalities, it is reasonable to assume that the same would hold for the rural municipalities.

5.1.2 The Relationship Between Income and Income Inequality

The development in the 16 Norwegian municipalities does not seem to fit the inverted U pattern. The pattern is more similar to an actual U, since income inequality first decrease, for then to increase. The inverted U hypothesis, as proposed by Kuznets [1950, 1955], focuses on the relationship between income and income inequality. So far in this thesis, only the relationship between income inequality and time has been investigated. Figure 5.1 shows the relationship between mean income and income inequality between 1892 and 1955 in the city municipalities. In the rural municipalities, the relationship is shown from 1937 to 1955, as this is the time span for which data on income inequality is available. The bottom right part of the figure shows the mean for all 16 municipalities. Before 1937 this mean only consists of city municipalities.

Figure 5.1: Mean Income and Income Inequality, 1892-1955



The relationship is downward sloping for most municipalities, and definitely on average. The only municipalities where income inequality does not clearly decrease with mean income is in Vinje and Røros between 1937 and 1955.

Lets now focus on the bottom, right part of Figure 5.1, showing the mean relationship between income and income inequality. It is clearly downward sloping. From 1892 to 1930, mean income was growing, and income inequality decreasing, and during the 1920s mean income declined while income inequality increased again. But in the 1930s there was a decrease in both mean income and income inequality, in contrast to the negative relationship for the rest of the period. It is difficult to explain why lower mean income meant lower income inequality in 1940, compared to 1930.

Figure 5.2: Mean Income and Income Inequality, 1967-2010

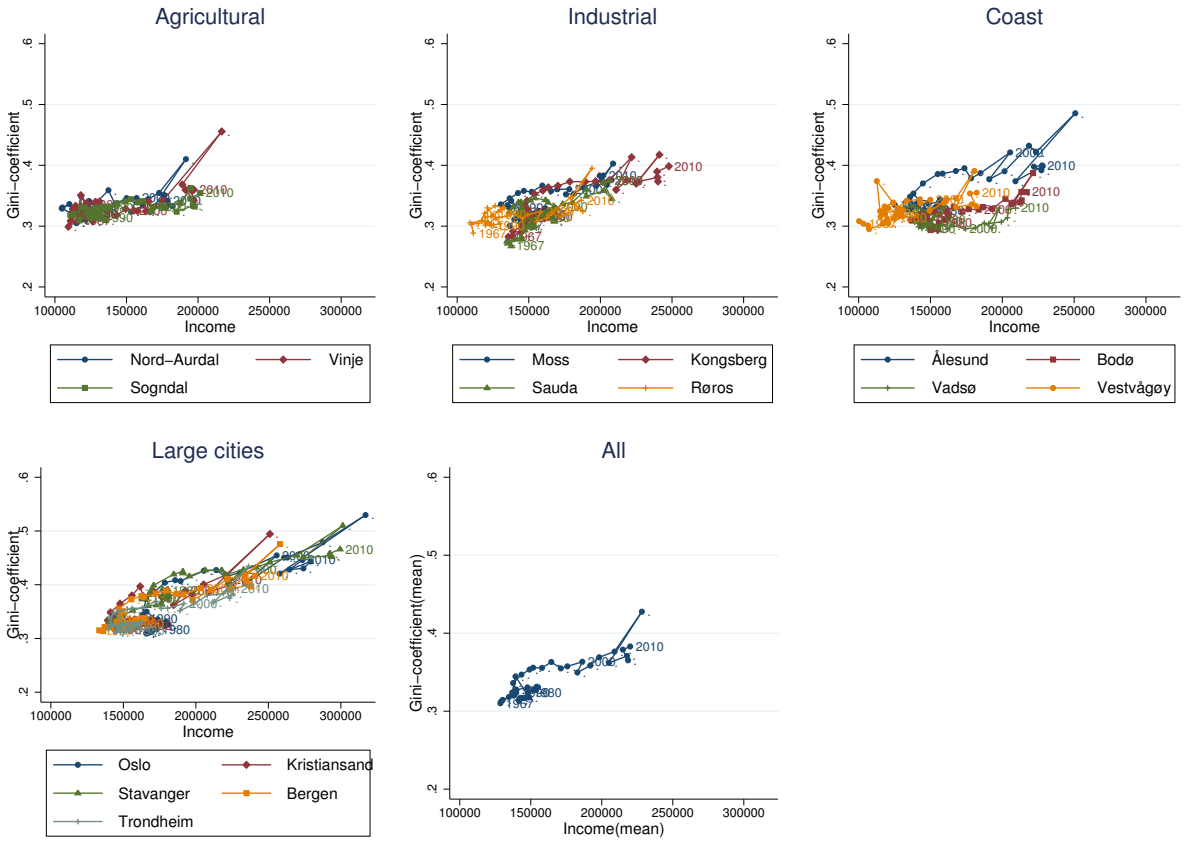


Figure 5.2. shows the same relationship between 1967 and 2010. The relationship between income inequality and mean income is clearly upward sloping for all municipalities. The upward sloping relationship is even clearer from the bottom, right graph, showing the average relationship in the municipalities over the whole period.

5.1.3 Possible Explanations for the Long- Run Trend in Income Inequality

Neither the relationship between income inequality and time nor the relationship between income inequality and mean income fit the pattern of an inverted U. Income inequality decrease, both with time and mean income, from 1892 to 1955. Then it stabilizes at a low level, for then to increase between 1990 and 2010. This does not fit the hypothesis of Kuznets [1950, 1955], but indeed it is in line with the more recent existing literature on income inequality and top income shares, as presented in section 2.

Further, the question is *why* income inequality has not developed according to the inverted U hypothesis. This question cannot be answered without further investigation, but this section

gives some possible explanations.

One reason that income inequality does not initially increase might be that the first estimates on income inequality are from 1892 for the city municipalities, and from 1937 for the rural municipalities. This might be after the period of increasing inequality had ended, meaning that we only observe the declining part of the inverted U curve.

The explanation for the decrease in income inequality between 1892 and 1967 is likely to be related to the negative shocks to capital incomes caused by the two world wars and the Great Depression prior to 1948 as explained by Atkinson and Piketty [2007]. It seems like the decreasing trend in income inequality has been more related to economic shocks, than to the gradual, structural change as proposed by Kuznets [1950, 1955]. Between 1948 and 1967 the top capital incomes did not increase again, and the explanation is probably related to the expansion of the welfare state securing more redistribution of income, and more equal rights to education and health services.

The development in income inequality is similar to the development in top income shares in Norway, shown in Aaberge and Atkinson [2010], and the income inequality in Norway as such as shown in Solbu [2009]. Lund [2012] finds that income inequality first rises, for then to decline in rural municipalities in total between 1894 and 1990. In the city municipalities, on the other hand, the trend is decreasing over the whole period. The results in this thesis are in line with the ones of Lund [2012] for the city municipalities. Since the data is more limited at municipality level for the rural municipalities, it is not possible to draw any conclusions about each of the rural municipalities in the years before 1937.

The increase in income inequality over the last decades may be related to an increase in the top capital incomes[10], as is the case for many European countries, according to Goldin and Katz [2008]. The increasing trend in income inequality in the municipalities after 1992 is also in line with the findings of Gottschalk and Smeeding [2000] for Norway as a whole. As mentioned in section 2, they find that income inequality increase in Norway, and in several other European countries, between 1990 and 2010. Since the poverty rate does not increase over this period, it is likely that the increase in income inequality is related to the top of the income distribution. This is also what Solbu [2009] and Lund [2012] find.

[10]Capital income is included in the income measure used in this thesis, as can be seen from the definition of assumed income and net income in section 3.3.2.

Since the recent increase in income inequality is most likely to be originated in the top of the income distribution, the explanation for the increase in income inequality might be the same as the one of Aaberge and Atkinson [2010] and Aaberge et al. [2013] regarding the increase in top income shares during the same period. They suggest that the deregulation of financial markets in 1984 and the reduction of tax on capital income in 1992 may be possible explanations for the increase in top income shares, although the business cycles and banking crisis may have postponed the increase in inequality to the early 1990s. The marginal tax rate on capital was gradually reduced from 1986 to 1992 to a flat rate of 28 per cent in 1992, giving more incentives to realize dividends and capital incomes. In addition, they mention that 1992 was the end of the Norwegian Banking crisis, and a turning point in the Norwegian business cycles, after an economic downturn during the previous years. The increase in income inequality that started in 1992 is thus also more likely to be related to shocks that affected top capital incomes than to gradual, structural changes. Still, this was also a period of structural change from traditional manufacturing to service industries, and one cannot rule out the possibility that this also had an affect on income inequality. Also, the enormous investments made connected to the discovery of natural resources such as oil, gas and fish may have contributed to more inequality as some people gain more than others on these resources. The government sector's role in managing these resources and secure a large degree of redistribution has counteracted this increase in inequality.

5.1.4 The Ups and Downs in Income Inequality

In addition to the long run trend in income inequality, one can observe that income inequality has both increased and decreased for periods. This can be related to the economic history of Norway as described in Hodne and Grytten [1992]. It decreased in the beginning of the 1900s. In this period the Norwegian economy went through a phase of moderate growth, after many years of historically strong growth. The decline in income inequality in this period might indicate that the economic downturn mainly affected the upper part of the income distribution. From 1920 to 1932 Norway experienced three economic crises, and although the economic growth continued, the unemployment rate increased significantly, and remained high until after the Second World War. In this period income inequality started increasing. The increase in income inequality, and the increased poverty rate, indicates that also the lower part of the income distribution was affected by these crises. After the Second World War income inequality steadily declined, in a period where the welfare state expanded, securing more redistribution and public support. From the 1960s income inequality was low and stable, but after the 1990s income inequality increased again. This increase in income inequality was partly driven by two upward jumps in income inequality, in 2000 and

2005. Both jumps are related to tax reforms. In 2001 there was a temporary tax reform on dividends, and in 2006 there was a permanent dividend tax. Aaberge and Atkinson [2010] find that the tax reforms on dividends gave an increase in the top income shares in 2000 and 2005, and a following decline the year the tax was introduced, which corresponds to the movements in income inequality in this thesis.

5.2 Has the Industry Structure in Norwegian Municipalities Converged Over the Last 150 Years?

In section 4.2 the development in industry structure in each municipality is showed. From the figures in that section it is clear that the industry structure in Norwegian municipalities has converged over the last 150 years.

In 1865 the industry structure differed quite a lot between the four categories of municipalities. In Nord-Aurdal, Vinje and Sogndal agriculture dominated the economy, and secondary- and tertiary industries were almost non existing. Also in the coast municipalities, the primary industries were important, but more because of a large fishery sector. In the industrial municipalities both primary- and secondary industries were of a certain size in 1865, while in the large cities secondary- and tertiary industries dominated. It might be that the municipalities were at different stages of the industrialization process in 1865. The large cities had already gone through this process, while in the agricultural municipalities it had not yet started.

In 2011 the industry structure was much more similar between municipalities. As emphasized in section 4.2, the development in industry structure over time within the category of agricultural municipalities and the category of large city municipalities coincided over the whole period, while it converged between the municipalities within the coast category and the industrial category. In addition, the industry structure converged also between municipalities in different categories. The municipalities ended up with a very similar industry structure in 2011, where tertiary industries dominated the economy, secondary industries were less important, and primary industries employed just a few per cent of the population.

If so, has this affected income growth or income inequality?

Then, the question is whether the convergence in industry structure between municipalities affected income in these municipalities. In particular, has there been a convergence in income growth or in income inequality. Figure 4.8 shows the development in mean income in all municipalities. The figure shows that there was a convergence in the level of mean income between the different categories of municipalities, which could be related to the convergence in industry structure. The development in mean income was very similar between the agricultural municipalities and between the large city municipalities, where the industry structure was also similar. Regarding the coast municipalities, mean income converged between the municipalities. The same is true for the industrial municipalities. This is exactly the same

Table 5.2: Convergence in Mean Income Growth, 1884-2010

Year	Gini- coefficient between municipalities	Average Annual Growth Rate	Coefficient of Variation 10 Year Growth Rate
1884-1894	0.28	2.24%	1.32
1894-1904	0.20	1.90%	0.60
1904-1914	0.06	2.46 %	0.89
1914-1924	0.11	0.29%	4.07
1923-1933	0.13	-1.00%	1.62
1933-1943	0.14	0.85%	2.69
1943-1953	0.20	6.61%	0.35
1955-1965	0.14	3.47%	0.53
1965-1975	0.13	5.35%	0.28
1975-1985	0.09	1.45%	0.55
1985-1995	0.08	1.73%	0.39
1995-2005	0.07	3.51%	0.37
2000-2010	0.07	0.59%	0.99

pattern as we saw for industry structure. Thus, it seems like the convergence in industry structure over time was related to the convergence in the level of mean income between the municipalities, even if no causal conclusions can be drawn.

Cuaresma et al. [2009] find the same results for several other European countries, and emphasize the increased share of educated workers in the labour force, as well as the developed infrastructure in these countries when explaining the convergence in income between different regions. These explanations could also be related to structural change, and might be particularly relevant when explaining that the rural municipalities caught up on cities. In rural municipalities infrastructure was traditionally less developed and education opportunities poorer, and the industrialization process in rural areas is possibly related to increased education opportunities and improved infrastructure.

Figure 4.8 only shows the level of mean income in each municipality graphically. The second column in Table 5.2 shows the income inequality between municipalities, in that it shows the Gini- coefficient[11], using the mean income in each municipality over time. This measure confirms the indication from Figure 4.8 in that the level of mean income converges between municipalities over time. The third column in Table 5.2 shows the average yearly income growth rate in all municipalities over certain periods. In addition, the fourth column shows the coefficient of variation of the growth rate in the third column. If the latter measure

[11]The Gini-coefficient is shown for the first year of the time interval in column one, meaning it is shown in 1884, 1894, 1904 and so on, but it is shown for 2010 in the last row to cover the whole period.

becomes smaller over time, this is an indication of a convergence in mean income growth. The figures suggest that this could indeed be the case, especially when only including figures up until 2005. There has, however, been a recent increase in the coefficient of variation of the growth rate between municipalities, meaning that it is difficult to make any clear conclusions from this table, without further investigation.

Table 5.3: Coefficient of Variation of Income Inequality in the 16 Municipalities

Year	City Municipalities	Rural Municipalities	All municipalities
1892	0.074		
1900	0.076		
1913	0.080		
1924	0.173		
1930	0.124		
1940	0.132	0.160	0.138
1950	0.167	0.087	0.145
1955	0.115	0.074	0.113
1967	0.047	0.073	0.058
1980	0.073	0.028	0.059
1990	0.061	0.024	0.054
2000	0.124	0.027	0.121
2010	0.099	0.034	0.101

But is this true also for income inequality? One hypothesis is that income inequality has converged between municipalities, meaning that income inequality varied more between municipalities in the beginning of the period, as found in Soltow [1965] and Mjelve [1998]. The argument is that the municipalities in that period were more different from each other, and more dependent on particular industries. For example, the economies in Røros and Kongsberg were dominated by mining. Nord-Aurdal, Vinje and Sogndal were more dependent on agriculture, and large city municipalities along the coast were dependent on trade and the international economic situation. This gave different income distributions in the different municipalities, and the economy in each municipality was more affected by changes in the industry they depended on. Today, all 16 municipalities are relatively similar, with a large share of the population employed in tertiary industries, and the economies are less dependent on one particular sector.

Table 5.3 shows the coefficient of variation of income inequality, meaning that it shows how much variation there is in income inequality between the municipalities. From 1892 to 1955 the variation in income inequality between the municipalities both increased and decreased

for certain years. There was more variation in 1924, 1930, 1940 and 1950, which might suggest that the Great Depression and the recovery of the economy thereafter affected some municipalities to a large extent, while it affected others more moderately. There is no clear convergence in income inequality over this period, and it does seem like income inequality varied less between municipalities in 1955 than in 1892, which the findings of Soltow [1965] and Mjelve [1998] suggest. The results from this period do not support the hypothesis that a more similar industry structure is also related to a more similar income distribution.

From 1967 to 1990 the variation was more stable, and at a lower level than in 1892. These findings are more in line with the findings of Mjelve [1998] who studies the development up to 1990. The large changes in the variation in the beginning of the period also supports that the effect on each municipality of historical events striking one or a few industries, differed more before 1967 than after. But after 1990, when income inequality started increasing again, also the variation in income inequality between municipalities increased. There was in other words a divergence in income inequality between municipalities after 1990.

Further the question is what might explain this development. Again, one cannot answer this with certainty based on this analysis, but one can suggest possible explanations. The reason for the development up to 1990, meaning the convergence of income inequality between municipalities, as well as the income inequality being less responsive to historical shocks, might be twofold. One reason can be the one argued by Soltow [1965] and Mjelve [1998]. There was a clear convergence in industry structure among municipalities, as seen in Section 4.2. The industry structure was already similar between the largest cities and the agricultural municipalities in 1865. But in the two remaining categories, namely the industrial municipalities and the coast municipalities the industry structure was quite different in 1865, but very similar in 2011. Moreover, also the industry structure between categories has become more similar, and the industry structure is in fact quite similar in all municipalities in 2011. Tertiary industries have become the dominant industries in all municipalities, while primary industries play a limited role. A large part of tertiary industries is public services, which might be seen as more stable than the industries that dominated in many municipalities in the beginning of the period. Especially income from agriculture could be very variable, as it depended on more or less random factors such as temperature and precipitation. The convergence in industry structure, and the dominant role of tertiary industries today may explain parts of why income inequality, as well as mean income, has converged between municipalities up until 1990. It might also explain why income inequality, as well as mean income, was more stable over time after 1967.

The second reason can be the expansion of the government sector. This is partly related to the argument above, as the expansion of the government sector was a part of why tertiary industries grew. In addition, the government sectors role in securing redistribution, as well as general stable and secure economic conditions might also have contributed to the more stable development the last decades, and the convergence of income inequality between different areas in Norway before 1990.

The puzzle is then the divergence in income inequality after 1990, given that there has not been a corresponding divergence in industry structure, and the government sector has, if anything, become even more important. Still, the deregulation of the financial system in 1984 and the tax reform in 1992 might work as if the government evolved in the other direction, since the result might be less redistribution. This could explain the divergence in income inequality in Norway over the last decades.

6 Conclusions

In this thesis the local income development from the 1850s until today in 16 Norwegian municipalities was investigated, and related to Kuznets inverted U hypothesis. By using rich data material at municipality level in Norway, covering more than 150 years, it was possible to investigate whether the hypothesis of Kuznets holds when using new and more rich data material for Norway, and when expanding the time period to include the period from 1950 until today. There was many challenges when analyzing the historical data, and the results in this thesis are less accurate before 1967. Wherever these challenges influenced the results, this was commented upon during the analysis.

The first part of the thesis was a description of data, showing the development in five variables; population growth, industry structure, mean income, income inequality and poverty. The Norwegian economy has developed from a preindustrial economy with few cities and a small government sector to an economy based on modern service industries, large and populated cities and a sizable government sector. The economic growth was visible in all municipalities investigated in this thesis, with a steady growth in mean income, and a decline in the poverty rate. In addition, there was a convergence between municipalities, both in industry structure and mean income.

In the second part of the thesis, the findings from the data analysis and previous literature was discussed in relation to the two questions raised in the beginning of the thesis.

> *Has income inequality in Norwegian municipalities been rising or falling over the last 150 years?*

The results in this thesis suggest that income inequality declined until the beginning of the 1990s, but after this the trend has been increasing. This gives a relationship between income inequality and economic growth that is more similar to an actual U than the inverted U, as found by Kuznets. The recent increase in income inequality is likely to be related to a deregulation of financial markets in 1984 and reduced taxes on capital income in 1992. In addition, 1992 was the end of the Norwegian banking crisis, and a turning point in the Norwegian business cycles, after an economic downturn during the previous years. This was also a period of structural change from traditional manufacturing to service industries.

> *Has the industry structure in Norwegian municipalities converged over the last 150 years? If so, has this affected income growth or income inequality?*

The industry structure between municipalities has converged over the period. This convergence was also seen in mean income, and in income inequality before 1990. After 1990, however, income inequality between municipalities diverged.

This thesis describes the income development in the municipalities in an historical perspective. There are also some attempts at explaining the observed trends and relationships. Much of the work related to this thesis has been to track down the available income data at municipality level dating far back in time, and to provide an overview of this material. The scope of this thesis is in this way to broad to provide a theoretical foundation for all variables and quantitative methods for investigating possible causal relationships. Some of the findings could have been interesting to investigate further. In particular, an attempt of explaining the increase in income inequality after 1990 more formally. Also the divergence between municipalities could have been investigated further. In addition, the relationship between local industry structure at a more detailed level and income inequality could have been studied in more detail.

References

R. Aaberge. Gini's Nuclear Family. *J. Econ Inequal*, 5:305–322, 2007.

R. Aaberge and A.B. Atkinson. *Top Incomes a Global Perspective, Top Incomes in Norway.* New York: Oxford University Press, 2010.

R. Aaberge, A.B. Atkinson, and J. Modalsli. The ins and outs of top income mobility. *Discussion Papers, Statistics Norway*, 2013.

A. B. Atkinson and T. Piketty. *Top Incomes Over the 20th Century.* Oxford University Press Inc., New York, 2007.

A.B. Atkinson. Piecing Together the Norwegian Income Distribution 1859- Present. *Inpublished Paper*, 2012.

J. C. Cuaresma, G. Doppelhofer, and M. Feldkircher. The Determinants of Economic Growth in European Regions. *CESifo Working Paper*, 2009.

K. R. Gerdrup. Skattesystem og skattestatistikk i et historisk perspektiv (In Norwegian, The Tax System and Tax Statistics in an Historical Perspective). *Reports Statistics Norway*, 1998.

C. Goldin and L.F. Katz. *The Race between Education and Technology.* The Belknap Press of Harvard University Press, 2008.

P. Gottschalk and T. Smeeding. Empirical Ecvidence on Income Inequality in Industrialized Countries. *Handbook of Income Distribution*, 1:261–307, 2000.

F. Hodne. *Norges okonomiske historie 1815-1970 (In Norwegian, The Norwegian Economic History 1815-1970).* J.W. Cappelens Forlag AS, 1981.

F. Hodne and O.H. Grytten. *Norsk okonomi 1900-1990 (In Norwegian, The Norwegian Economy 1900-1990).* Oslo: TANO AS, 1992.

D. Juvkam. Historisk oversikt over endringer i kommune- og fylkesinndelingen (In Norwegian, Historical Overview of Changes in the Municipal- and County Division). *Reports Statistics Norway*, 1999.

S. Kuznets. Shares of Upper Income Groups in Income and Saving. *New York: National Bureau of Economic Research*, 1950.

S. Kuznets. Economic Growth and Income Inequality. *The American Economic Review*, pages 1–28, 1955.

P.H Lindert and J.G. Williamson. *Growth, Equality and History.* Harvard Institute for Economic Research, 1985.

M.E. Lund. Inntektsfordelingen i Norge i et historisk perspektiv (In Norwegian, The Income Distribution in Norway in an Historical Perspective). Master's thesis, UiO, 2012.

S. Mjelve. Okonomisk vekst og fordeling av inntekt i byene i Vest-Agder og Ostfold, 1840-1990 (In Norwegian, Economic Growth and the Distribution of Income in the Cities in Vest-Agder and Ostfold, 1840-1990). *Oslo-Kongsvinger: Statistics Norway*, 1998.

Norges Bank. Consumer Price Indices, Tables in XLSX. *http://www.norges-bank.no/en/price-stability/historical-monetary-statistics/consumer-price-index/*, 2013.

NSD Kommunedatabase. Arbeidsliv 1835-2013 (In Norwegian, Employment 1835-2013). *https://trygg.nsd.uib.no/kdbbin/kategorier.exe?katalog=ok*, 2013a.

NSD Kommunedatabase. Befolkning 1769-2013 (In Norwegian, Population 1769-2013). *https://trygg.nsd.uib.no/kdbbin/kategorier.exe?katalog=ok*, 2013b.

NSD Kommunedatabase. Folkemengden etter alder, kjonn og ekteskapelig status (In Norwegian, Population After Age, Sex and Marital Status). *https://trygg.nsd.uib.no/kdbbin/kategorier.exe?katalog=ok*, 2013c.

Parliamentary Propositions. *State Tax Statistics.* 1892-1936.

D. Ray. *Development Economics.* Princeton University Press, 1998.

E. Sobye. Historien bak aldrende befolkning (In Norwegian, The Story Behind an Aging Population). *Samfunnsspeilet*, 2/2012:6–13, 2012.

P. Solbu. Inntektsulikhet i Norge 1858-2006 (In Norwegian, Income Inequality in Norway 1858-2006). Master's thesis, UiO, 2009.

L. Soltow. *Toward Income Equality in Norway.* The University of Wisconsin Press, 1965.

Statistics Norway. Sosialt Utsyn 1974 (In Norwegian, Social Views 1974). SA 10 1974: 195–198, 1974.

Statistics Norway. Skattestatistikk for forskuddspliktige (In Norwegian, Tax statistics for Personal Tax Payers). *NOS D 324*, 2005.

Statistics Norway. Endringer i kommuneinndelingen og andre regionale inndelinger (In Norwegian, Changes in the Municipal Division and Other Regional Divisions). *Kommunekatalogen*, 2012.

Statistics Norway. Statistikkbanken; Okonomisk sosialhjelp, 2000-2012 (In Norwegian, The Statistics Bank; Social Assistance, 2000-2012). 2013a.

Statistics Norway. Historisk statistikk; Norges kommunale finanser, 1884-1937 (In Norwegian, Historical Statistics; Norway's Municipal Finances, 1884-1937). *https://www.ssb.no/a/histstat/publikasjoner/*, 2013b.

Statistics Norway. Historisk statistikk; Skattestatistikk, 1937-1966 (In Norwegian, Historical Statistics; Tax Statistics, 1937-1966). *https://www.ssb.no/a/histstat/publikasjoner/*, 2013c.

Statistics Norway. Personal Tax Data, 1967-2010. 2013d.

Statistics Norway. Historisk statistikk; Fattigvesen og Sosialhjelpstatistikk 1866-1974 (In Norwegian, Historical Statistics, Poor Relief and Social Statistics 1866-1974). *https://www.ssb.no/a/histstat/publikasjoner/*, 2013e.

M. Thomas. *Income Distribution in Historical Perspective, The evolution of inequality in Australia in the nineteenth century.* Cambridge University Press, 1991.

J.G. Williamson. *Income Distribution in Historical Perspective, Bristish inequality during the industrial revolution: accounting for the Kuznets curve.* Cambrigde University Press, 1991.

A APPENDIX: POPULATION TRANSFERS BETWEEN MUNICIPALITIES 1859-2010

Year	Municipality	Population transferred	From	To
1859	Oslo	9551	Aker	
1860	Vinje	233	Rauland	
1864	Trondheim	1229	Strinda	
1866	Bodø	-886		Nesseby
1867	Stavanger	200	Hetland	
1875	Ålesund	902	Sula	
1876	Moss	631	Jeløy	
1877	Bergen	4883	Bergen L.D.	
1878	Oslo	18970	Aker	
1879	Stavanger	1357	Hetland	
1893	Trondheim	4097	Strinda	
1894	Nord Aurdal	-1331		Etnedal
1894	Vadsø	-1296		Nord-Varanger
1906	Stavanger	399	Hetland	
1915	Bergen	7463	Årstad	
1919	Buksnes	-3188		Hol
1921	Kristiansand	2164	Oddernes	
1921	Bergen	1734	Laksevåg	
1922	Ålesund	1148	Sula	
1923	Stavanger	3063	Hetland	
1925	Moss	30	Jeløy	
1926	Røros	-2782		Several[12]
1927	Borge	625		Valberg
1938	Moss	2154	Rygge	
1938	Bodø	559	Bodin	
1943	Moss	4243	Jeløy	
1948	Oslo	130976	Aker	
1952	Trondheim	2230	Strinda	
1953	Stavanger	831	Hetland	
1955	Bergen	1590	Fana	

[12] Røros Landssogn, Brekken and Glomås

1959	Bodø	1303	Bodin	
1963	Vestvågøy	12288	Several[13]	
1964	Kongsberg	6350	Several [14]	
1964	Vinje	1656	Rauland	
1964	Sogndal	5	Leikanger	
1964	Røros	2146	Several[15]	
1964	Trondheim	54437	Several[16]	
1964	Vadsø	1587	Nord-Varanger	
1965	Kristiansand	23142	Several[17]	
1965	Stavanger	26886	Several[18]	
1966	Bergen	4	Fana	
1968	Ålesund	20132	Borgund	
1968	Bodø	13323	Bodin	
1972	Bergen	100045	Several[19]	
1977	Ålesund	-6302		Sula
1984	Bodø	22	Sørfold	
2000	Sogndal	283	Balestrand	
2005	Bodø	1030	Skjerstad	

Source: Juvkam [1999]Statistics Norway [2012]

[13] Buksnes, Hol, Borge and Valberg
[14] Ytre Sandsvær, Øvre Sandsvær, Flesberg and Gransherad
[15] Røros Landssogn, Brekken and Glomås
[16] Leinstrand, Byneset, Strinda and Tiller
[17] Randesund, Oddernes and Tveit
[18] Madla and Hetland except Riska Sogn and Dale krets
[19] Laksevåg, Fana, Arna and Åsane

B APPENDIX: OVERVIEW OF DATA SOURCES

SM: Statistical Notices

PC: Population Census

PS: Poverty Statistics

MT: Municipal Tax Statistics

ST: State Tax Statistics

PTD: Personal Tax Data

PR: Population Register

SB: Statistic Bank

Year	Mean Income	Income Inequality	Poor	Population	Industry Structure
1859	SM 1892				
1865				PC 1865	PC 1865
1866			PS 1866		
1867			PS 1867		
1868			PS 1868		
1869			PS 1869		
1870			PS 1870		
1871			PS 1871		
1872			PS 1872		
1873			PS 1873		
1874			PS 1874		
1875			PS 1875	PC 1875	
1876			PS 1876		
1877			PS 1877		
1878			PS 1878		
1879			PS 1879		
1880			PS 1880		
1881			PS 1881		
1882			PS 1882		
1883			PS 1883		
1884	MT		PS 1884		
1885	MT		PS 1885		
1886	MT		PS 1886		
1887	MT		PS 1887		

1888	MT		PS 1888		
1889	MT		PS 1889		
1890	MT		PS 1890		
1891	MT		PS 1891	PC 1891	PC 1891
1892	MT	MT, ST, PS, PC[20]	PS 1892		
1893	MT	MT, ST, PS, PC	PS 1893		
1894	MT	MT, ST, PS, PC	PS 1894[21]		
1895	MT	MT, ST, PS, PC	PS 1895		
1896	MT[22]	MT, ST, PS, PC	PS 1896		
1897	MT	MT, ST, PS, PC	PS 1897		
1898	MT	MT, ST, PS, PC	PS 1898		
1899	MT	MT, ST, PS, PC	PS 1899		
1900	MT	MT, ST, PS, PC	PS 1900	PC 1900	PC 1900
1901	MT	MT, ST, PS, PC	PS 1901		
1902	MT	MT, ST, PS, PC	PS 1902		
1903	MT	MT, ST, PS, PC	PS 1903		
1904	MT	MT, ST, PS, PC	PS 1904		
1905	MT	MT, ST, PS, PC	PS 1905		
1906	MT	MT, ST, PS, PC	PS 1906		
1907	MT	MT, ST, PS, PC	PS 1907		
1908	MT	MT, ST, PS, PC	PS 1908		
1909	MT	MT, ST, PS, PC	PS 1909		
1910	MT	MT, ST, PS, PC	PS 1910	PC 1910	PC 1910
1911	MT	MT, ST, PS, PC	PS 1911		
1912	MT	MT, ST, PS, PC	PS 1912		
1913	MT	MT, ST, PS, PC	PS 1913		
1914	MT		PS 1914		
1915	MT		PS 1915		
1916	MT		PS 1916		
1917	MT		PS 1917		
1918	MT		PS 1918		
1919	MT		PS 1919		
1920	MT		PS 1920	PC 1920	
1921	MT				

[20] Only figures for the city municipalities in 1892-1937. Population data, and poverty data are linearly inter pooled

[21] Only figures for the city municipalities in 1894, 1896-99, 1901-04, 1906-09, 1911-14, 1916-19.

[22] Only figures for the city municipalities in 1896-1933

1922	MT				
1923	MT	MT, ST, PS, PC			
1924	MT	MT, ST, PS, PC			
1925	MT	MT, ST, PS, PC			
1926	MT	MT, ST, PS, PC			
1927	MT	MT, ST, PS, PC			
1928	MT	MT, ST, PS, PC			
1929	MT	MT, ST, PS, PC			
1930	MT	MT, ST, PS, PC		PC 1930	
1931	MT	MT, ST, PS, PC			
1932	MT	MT, ST, PS, PC	PS 1932[23]		
1933	MT	MT, ST, PS, PC	PS 1933		
1934			PS 1934		
1935			PS 1935		
1936					
1937	MT	MT, ST, PS, PC			
1938	MT	MT, ST, PS, PC			
1939	MT	MT, ST, PS, PC			
1940	MT	MT, ST, PS, PC			
1941	MT	MT, ST, PS, PC			
1942	MT	MT, ST, PS, PC			
1943	MT	MT, ST, PS, PC			
1944	MT	MT, ST, PS, PC			
1945	MT	MT, ST, PS, PC			
1946	MT	MT, ST, PS, PC		PC 1946	PC 1946
1947	MT	MT, ST, PS, PC			
1948	MT	MT, ST, PS, PC			
1949					
1950	MT	MT, ST, PS, PC		PC 1950	PC 1950
1951	MT	MT, ST, PS, PC		PC 1951	
1952	MT	MT, ST, PS, PC		PC 1952	
1953	MT	MT, ST, PS, PC		PC 1953	
1954	MT	MT, ST, PS, PC		PC 1954	
1955	MT	MT, ST, PS, PC		PC 1955	
1956				PC 1956	

[23] Only figures for Oslo, Stavanger, Bergen and Trondheim in 1932-35

1957	MT			PC 1957	
1958				PC 1958	
1959				PC 1959	
1960				PC 1960	PC 1960
1961	MT			PC 1961	
1962				PC 1962	
1963				PC 1963	
1964				PC 1964	
1965	MT			PC 1965	
1966				PC 1966	
1967	PTD	PTD	PS 1967	PC 1967	
1968	PTD	PTD		PR 1968	
1969	PTD	PTD		PR 1969	
1970	PTD	PTD		PR 1970	PC 1970
1971	PTD	PTD		PR 1971	
1972	PTD	PTD		PR 1972	
1973	PTD	PTD		PR 1973	
1974	PTD	PTD	PS 1974	PR 1974	
1975	PTD	PTD		PR 1975	
1976	PTD	PTD		PR 1976	
1977	PTD	PTD		PR 1977	
1978	PTD	PTD		PR 1978	
1979	PTD	PTD		PR 1979	
1980	PTD	PTD		PR 1980	PC 1980
1981	PTD	PTD		PR 1981	
1982	PTD	PTD		PR 1982	
1983	PTD	PTD		PR 1983	
1984	PTD	PTD		PR 1984	
1985	PTD	PTD		PR 1985	
1986	PTD	PTD		PR 1986	
1987	PTD	PTD		PR 1987	
1988	PTD	PTD		PR 1988	
1989	PTD	PTD		PR 1989	
1990	PTD	PTD		PR 1990	PC 1990
1991	PTD	PTD		PR 1991	
1992	PTD	PTD		PR 1992	

1993	PTD	PTD		PR 1993	
1994	PTD	PTD		PR 1994	
1995	PTD	PTD		PR 1995	
1996	PTD	PTD		PR 1996	
1997	PTD	PTD		PR 1997	
1998	PTD	PTD		PR 1998	
1999	PTD	PTD		PR 1999	
2000	PTD	PTD	SB	PR 2000	
2001	PTD	PTD	SB	PR 2001	
2002	PTD	PTD	SB	PR 2002	
2003	PTD	PTD	SB	PR 2003	SB
2004	PTD	PTD	SB	PR 2004	
2005	PTD	PTD	SB	PR 2005	
2006	PTD	PTD	SB	PR 2006	
2007	PTD	PTD	SB	PR 2007	
2008	PTD	PTD	SB	PR 2008	
2009	PTD	PTD	SB	PR 2009	
2010	PTD	PTD	SB	PR 2010	
2011			SB	PR 2011	SB
2012			SB	PR 2012	

The figures that are used to make all graphs and tables throughout the thesis are available upon requests.

C APPENDIX: OVERVIEW OF CATEGORIZATION OF INDUSTRY GROUPS

Year	Primary industries	Secondary Industries	Tertiary Industries	Other industries
1865	Agriculture, fisheries and more	Mining and industry in all	Trade, shipping and transportation in all	Work of indefinite character
			Immaterial labour	Unproductive work
1891	Agriculture and more	Mining and more	Trade and more	Other and unspecified
	Gardening and more	Quarry and more	Accommodation and catering	House work
	Forestry and hunting	Industry	Transportation and railways	Property income, pensions and more
	Fisheries	Craft and more	Shipping	Public support
1900	Agriculture, forestry and hunting	Mining, manufacturing, quarries and more	Trade, marketing and transportation	Public support
	Fisheries	Craft	Shipping	Unspecified work and more
		Other industrial activities	Public- and other immaterial work	
1910	Agriculture, forestry and hunting	Mining, manufacturing, quarries and more	Trade, marketing and transportation	Unspecified work, public support and more
	Fisheries	Craft	Shipping	
		Other industrial activities	Public- and other immaterial work	
1946	Agriculture, forestry and gardening	Crafts and industry	Business services	Unknown
	Fisheries		Transportation	
			Immaterial activities	
			House work at institutions	
1950	Agriculture, forestry and gardening	Industry and more	Business services	Property income, pensions and more
	Fisheries		Transportation	Unknown
			Other services	
1960	Agriculture, forestry and gardening	Industry and more	Business services	Property income, pensions and more

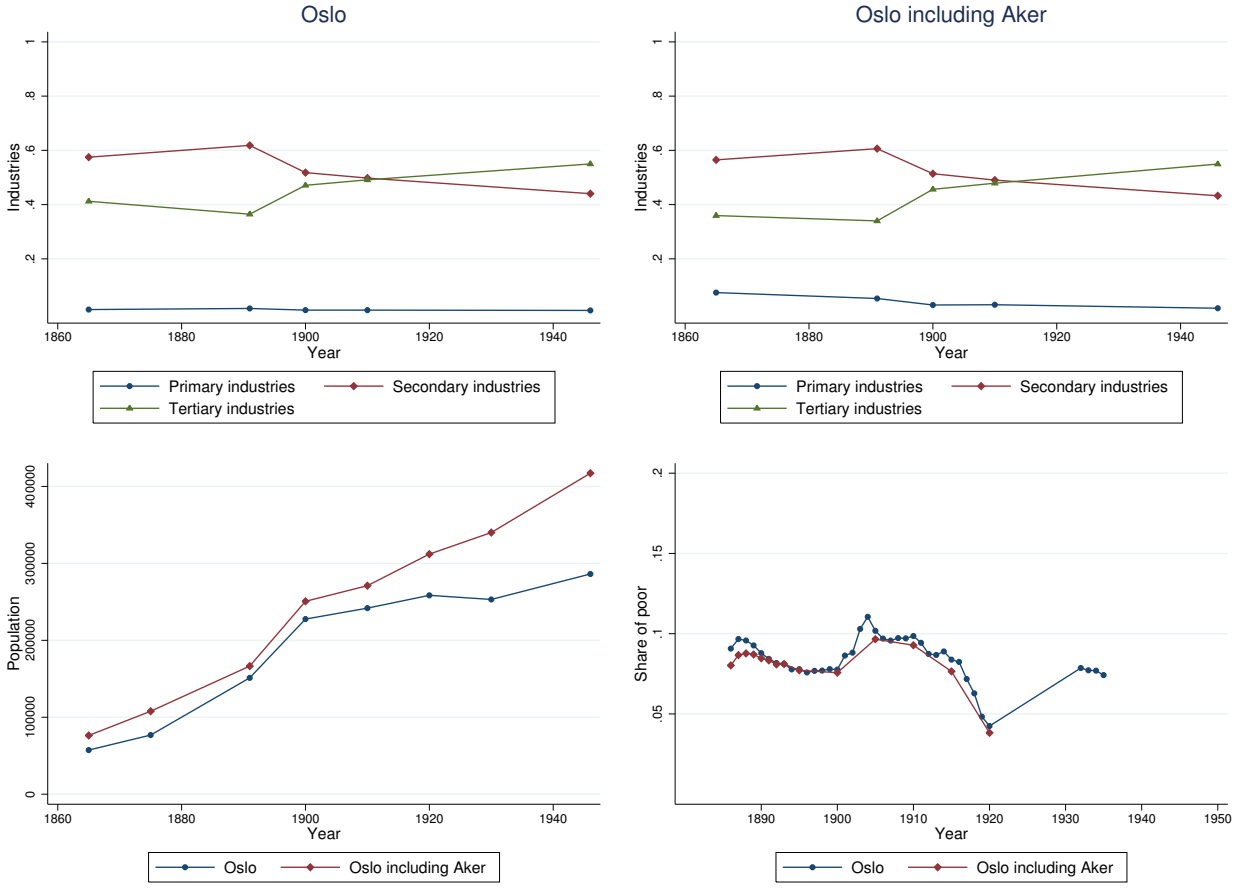
	Fisheries		Transportation Other services	Unknown
1970	Agriculture Forestry Fisheries	Industry in all Construction Power Oil extraction and mining	Retail Hotels and restaurants Transportation Bank and finance Insurance, real estate and business services Public services Renovation Education and research Health and social services Cultural services Personal services	Unknown
1980	Agriculture Forestry Fisheries	Industry in all Construction Power Oil extraction and mining	Retail Hotels and restaurants Transportation Bank and finance Insurance, real estate and business services Public services Renovation Education and research Health and social services Cultural services Personal services	Unknown
1990	Agriculture, forestry and fishery	Industry in all Construction	Retail, hotels and restaurants Transportation and more	

		Power	Bank, finance, insurance, real estate and business services	
		Oil extraction and mining	Public, social and private services	
1995	Fishery	Industry and mining	Retail	
		Power	Transportation	
		Construction	Financial services and insurance	
		Oil extraction including services	Business services	
			Public services and more	
2003	Agriculture, forestry and fishery	Industry, mining, oil- and gas extraction	Retail	Unknown
		Power	Transportation	
		Construction	Financial services	
			Business services and real estate	
			Public services	
			Other social and personal services	
2011	Agriculture, forestry and fishery	Industry	Retail	Unknown
		Power and renovation	Transportation and storage	
		Construction	Accommodation and catering	
		Mining and extraction	Information and communication	
			Finance and insurance	
			Technical services and real estate	
			Business services	
			Public services	
			Personal services	

D APPENDIX: CREATING A MUNICIPALITY GROUP FOR OSLO

As explained in section 3, all municipal border changes are ignored in the analysis of the ten city municipalities. Here, an additional analysis of the city municipality, Oslo, is included. The results are based on the area of Oslo and Aker. Only a few, small population transfers[24] between this area and other municipalities in Norway have taken place during the time period from 1859 to 2012.

Figure D.1: Results for Oslo Including Aker



[24] 40 people was transferred from Aker to Oppegård in 1947, and 53 people from Skedsmo to Oslo in 1980.

Figure D.2: Mean income and income inequality

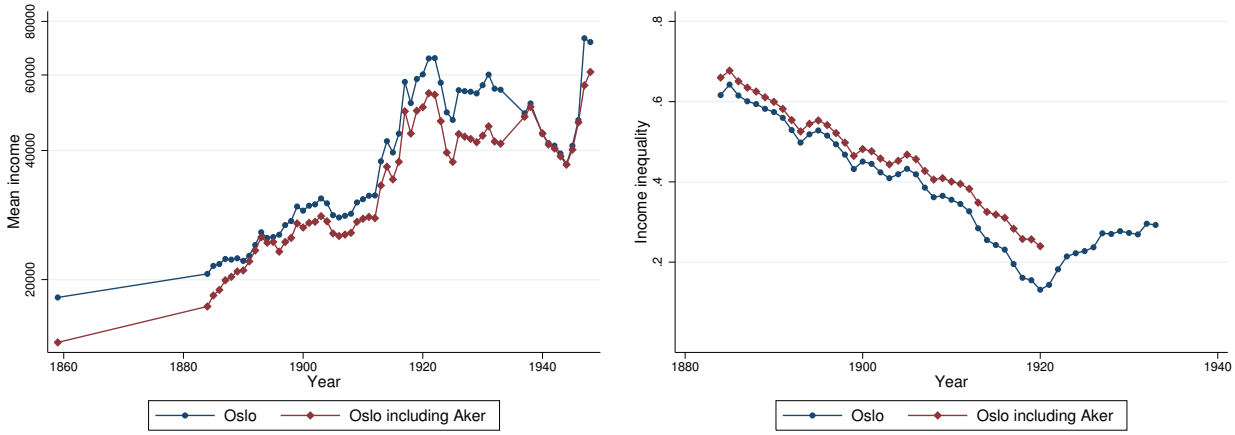


Figure D.1 shows the development in industry structure, population and the share of poor, both for Oslo as in the rest of the analysis and for Oslo including Aker. In 1948, Aker and Oslo were merged, meaning that the results after this will be identical to the ones in the rest of the thesis, and are therefore not included here. From 1859 to 1948 the poverty data is more limited for Aker, which is a rural municipality. Therefore the whole time period is not covered when including Aker. The results are presented here to argue that adding a group of municipalities to the city municipalities would not necessarily improve the analysis or make it any more consistent.

Figure D.2 shows the development in mean income and income inequality. The figures on income per adult is lower when including Aker in some years. The reason is that there are data for both Aker and Oslo on the adult population during the whole time period, while the income data is more limited. At some points in time the measure on mean income will be the income registered in Oslo divided by the population in both Oslo and Aker. This exemplifies one of the arguments for not adding rural municipalities to the city municipalities. An alternative measure could be mean income for Oslo and Aker, only when there are income data for Aker. But then this measure would only cover the period from 1884 to 1895 and from 1937 to 1948.